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for the Behavioral and Social Sciences

Research Report 1718

Staff Group Trainer: Development of a Computer-Driven, Structured, Staff Training Environment

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March 1998

U.S. Army Research Institute
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14. ABSTRACT *(Maximum 200 words)*:

The Staff Group Trainer Project was a research and development effort sponsored by the U.S. Army Research Institute for the Behavioral and Social Sciences in coordination with the Force XXI Program. The project produced two training support packages (TSP)--battalion and brigade--designed to train these staffs to more effectively and efficiently communicate within and between staff sections, command post, and the unit commander. Based on tactical scenarios developed for the Virtual Training Program, both TSPs focused on staff functions that support the military decision-making process within the execution phase of the movement to contact, deliberate attack, battalion defense in sector and brigade area defense missions. The TSP design and development were based on lessons learned from previous Virtual Training Program efforts, structured design methodology, and adult learning principles. This report provides details on the Staff Group Trainer Project's history, methodology, and lessons learned.

15. SUBJECT TERMS

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Education and Training Technology

FOREWORD

The Innovative Tools and Techniques for Brigade and Below Staff Training (ITTBBST) program is part of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) ongoing research to establish innovative methods for training combined arms forces. The ITTBBST program has three major parts: Battlefield Functions (BFs), Battle Staff Training System (BSTS), and the Staff Group Trainer (SGT). The BFs are defined as processes or activities occurring over time that must be performed to accomplish a mission or supporting critical tasks. A BF provides task integration, combined arms interaction, and inter-Battlefield Operating System (BOS) linkages. The BSTS is a research program using paper and multimedia products to train brigade and battalion staff officers in basic skills necessary to perform their jobs. The SGT is a research and development (R&D) effort designed to train small staff groups in basic information management skills.

The current turbulence, staff experience levels and lack of effective training opportunities in battalion and brigade staffs combine to create a training challenge for commanders. The SGT R&D effort is designed to provide the commander a tool he can use to meet this challenge. The purpose of the SGT R&D effort is to conduct research on training basic information management skills needed during mission execution by a new or inexperienced staff. The SGT assumes that individual staff members are knowledgeable in their individual areas. The SGT R& D program is designed to bridge the training gap between individual skills and integrated staff skills, preparing a staff for mission exercises in constructive simulations or field exercises.

The training objectives of the SGT are ten staff processes involved in the staff decision making cycle of see, assess, decide and act. The SGT R&D effort uses the structured training method. This involves developing detailed training support packages (TSPs) containing events (in this case, message traffic) causing the staff processes to be performed. Information is collected to provide feedback to the training audience concerning how well these processes were performed. This information is presented to the training audience in After Action Reviews (AARs) . Training progresses in difficulty using a crawl, walk, run sequence.

The SGT R&D effort consists of two TSPs, one for brigade and one for battalion. Each of these TSPs contain tables training staff processes associated with staff section, command post and command and control levels. The TSPs use computers to emulate communications systems in delivering a stream of scripted messages from higher, lower and adjacent headquarters. Information on performance of staff processes is recorded by both computers and a minimum number of observer controllers using checklists describing staff actions expected based on the message stream (or cues) received by the staff. The turnkey features, train the trainer materials, and TSPs are aimed at making this an easy to use program that requires minimum preparation time on the part of the commander and his staff to train staff processes in the execution phase of a unit mission

This report documents the methodology and lessons learned in the SGT project. The report describes the rationale on which the R&D program is based, overall design of SGT, software, exercise and TSP development, the formative evaluation, lessons learned and overall

conclusions. The report provides researchers and decision makers an overall understanding of the SGT R&D effort.

The SGT has been used by the 149th Armored Brigade of the Kentucky National Guard, and is slated for use by a brigade of the Texas National Guard. Upon completion of the R&D effort, it will be delivered to the Directorate of Training and Doctrinal Development (DTDD) of the U. S. Army Armor School and Center at Fort Knox, KY. The DTDD will make decisions concerning future refinement, use, and prospective fielding of the SGT R&D effort and its products.

ZITA M. SIMUTIS
Technical Director

STAFF GROUP TRAINER: DEVELOPMENT OF A COMPUTER-DRIVEN, STRUCTURED, STAFF TRAINING ENVIRONMENT

EXECUTIVE SUMMARY

Research Requirement:

Maneuver staffs needed a tool to bridge the training gap between the skills achieved through individual training and the collective skills required of an entire battalion or brigade staff. The contemporary battlefield inundates a staff with information. Battalion and brigade staffs must possess strong information management skills if they are to perform their mission successfully. Staff members must attend to more information while responding with greater detail and speed than ever before.

At the same time, factors such as downsizing, decreasing defense budgets, and the emergence of advanced battlefield weaponry are impacting training requirements. These factors create a need for less resource intensive training. An outcome of this evolution is an Army need to develop innovative programs aimed at training soldiers to function effectively as battalion and brigade staffs on the modern battlefield.

The goal of this research and development effort was to develop computer-driven, structured staff training focused on the military decision-making process. The program was to develop innovative tools and techniques to bridge the training gap between individual skills training and the collective level of interaction and tactical decision-making provided by the constructive simulation staff training environment.

Procedure:

The development team analyzed the gap in staff training between individual training and collective training on the Janus or Brigade/Battalion Battle Simulation (BBS) simulations and designed two training programs--battalion and brigade--to bridge that gap. Each training program was composed of progressive tables advancing from individual staff section to command post (CP) and then to command and control (C^2) tables. A C^2 table involved multiple CPs. Each table was divided into modules--section specific modules for the staff section table, CP modules (e.g., tactical, main, and rear CP modules for the brigade program) for the CP table, and mission (movement to contact, defense [battalion defense in sector and brigade area defense], and deliberate attack) modules for the C^2 table. Within each module, the team developed 2-4 exercises with support materials, organized into a training support package (TSP) for each program--battalion and brigade. After internal testing of the exercises, the exercises and training system were pilot tested with soldiers. After making suggested modifications in the exercises and TSPs, the training programs were tested with surrogate staffs and a training team. Suggestions from these tests were incorporated into the final TSPs.

At the start of the project, the Staff Group Trainer hardware suite consisted of six Sun SPARC workstations linked by a local area network (LAN). Two workstations were added later in the project. Each workstation consisted of two 19-inch color monitors, a keyboard, a

processor, and a mouse. A military tactical map was displayed on the left-hand monitor. A message display was on the right monitor. One workstation was used to control the exercise. This workstation sent pre-scripted messages to the other workstations.

Findings:

The concept of using a computer-driven, structured training environment to train new or inexperienced staffs was found to be viable. The computer system delivered scripted message lists that reduced training overhead. Approaches for unit training preparation and methods for structuring the after action review (AAR) were observed to benefit the trainers and staff.

The training system needs further development for staff use. Staff personnel cannot afford to invest time in learning how to use a training system that differs from their operational systems. The training program must either emulate or run on actual equipment or require minimal training time.

The multimedia general situation previews were very effective in preparing the staff for the exercise. A similar presentation in the form of specific section previews should be developed for each staff section. Staffs must be brought into both the general situation and the specific situation for their section. The multimedia presentation has the potential of rapidly meeting this challenge. A staff process model (graphic) proved to be an effective means of focusing the staff on task performance. This graphic presentation of staff actions was effective in AARs. The multimedia-assisted, end-of-module AAR aided the commander and training team in presenting a focused AAR.

Utilization of Findings:

The Staff Group Trainer developed two staff training support packages--battalion and brigade. More work is required to refine these programs and the delivery system into a useable tool for the commander in the field. Ultimately, battalion and brigade staffs will be able to use these training programs to develop staff proficiency and enhance combat readiness. Follow-on research can build on the foundation established by this project to improve both the delivery system and the training programs. Future sponsors, designers, developers, and trainers can benefit by applying the lessons learned.

STAFF GROUP TRAINER: DEVELOPMENT OF A COMPUTER-DRIVEN, STRUCTURED, STAFF TRAINING ENVIRONMENT

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STAFF GROUP TRAINER: DEVELOPMENT OF A COMPUTER-DRIVEN, STRUCTURED STAFF TRAINING ENVIRONMENT

INTRODUCTION

The Staff Group Trainer[1] Project was a research and development program to develop computer-aided, structured staff training using the execution phase of three combat missions: movement to contact, defense, and deliberate attack--to focus on the military decision-making process. The Staff Group Trainer Project produced two separate training support packages (TSP)--one for a heavy maneuver battalion/task force, and one for a heavy maneuver brigade. Within both TSPs, the exercises were designed to be progressively more difficult (crawl, walk, run). Both programs contained three components--staff section exercises (training within the section, or "intra-staff"), Command Post (CP) exercises (training within the whole CP, i.e., between sections or "inter-staff"), and Command and Control (C^2) exercises (training between CPs, e.g., main and rear CPs).

Background

Current evolution of the U.S. Army requires innovation in manning, training, and equipping the force. Factors such as downsizing, decreasing defense budgets, and the emergence of advanced battlefield weaponry are creating new training requirements. These factors clearly create a need for less resource intensive training. Not only must a soldier of the 21st century possess new skills; he/she faces the challenges of increased staff turnover currently facing the Army. Additionally, data collected from the Combat Training Centers have identified deficiencies in training staff synchronization (Thompson, Pleban, & Valentine, 1994; Department of the Army, 1996). One outcome is an identified Army need to develop innovative programs aimed at training soldiers to function effectively as battalion and brigade staffs on the modern battlefield. The Staff Group Trainer Project addressed this need. This project was developed under the Force XXI Training Program (FXXITP), a program to carry the Army's training capabilities into the 21st Century (Department of the Army, 1994).

The contemporary battlefield inundates a staff with information. It is vital that battalion and brigade staffs possess strong information management skills if they are to successfully perform their mission. Staff members must attend to more information while responding with greater detail and speed than ever before. This challenges staff personnel and their capacity to process, analyze, coordinate and integrate information, and make recommendations.

The predecessor Commander/Staff Trainer (C/ST) was developed under the Simulation-based Multiechelon Training Program for Armor Units (SIMUTA) program. It consisted of a computer networked system with six workstations supporting a battalion staff exercise aimed at training information processing for principal staff officers in the main CP and combat trains CP

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[1] Staff Group Trainer was originally called Commander/Staff Trainer (C/ST). The name was changed in summer 1996.

processing for conventional forces, with staff officers directing disposition of incoming messages and creating minimal message traffic within a movement to contact scenario. Textual feedback modules linked to individual performance during the mission, focusing strictly on message handling and overlay maintenance, were present on individual workstations. The SIMUTA C/ST Project did not train staff interaction.

The SIMUTA Program was part of the Reserve Component Virtual Training Program (RCVTP). The RCVTP was established at Fort Knox, Kentucky to develop innovative structured training for the total armor force so that networked simulation technologies could be fully exploited. The RCVTP was redesignated the Virtual Training Program (VTP) to more accurately reflect a total force program.

The U.S. Army Research Institute for the Behavioral and Social Sciences' (ARI's) statement of work for a follow-on to the SIMUTA C/ST Project was included in the "Innovative Tools and Techniques for Brigade and Below Staff Training (ITTBBST)" Program. This program called for enhancements to the SIMUTA C/ST software and exercises and specified adding battalion-level defense in sector and deliberate attack missions and retrofitting the movement to contact mission developed for the SIMUTA C/ST Project. It also required development of brigade exercises for the area defense, deliberate attack, and movement to contact missions. Under the ITTBBST Program, the Staff Group Trainer Project became part of an integrated training strategy including the Battle Staff Training System (BSTS) based on Battlefield Functions (BFs)[2]. More information on BFs, particularly those related to command and control of the armored brigade, can be found in Ford, Mullen and Keesling (1997).

The BSTS Project developed computer-assisted instruction on individual staff skills for commanders and staff officers in armored and mechanized infantry battalions and brigades. The BF Project analyzed processes or activities performed to accomplish a mission or support critical tasks. The BFs provided developers in the BSTS and Staff Group Trainer Projects with detailed descriptions of C^2 functions emphasizing linkages and dependencies among maneuver, combat support, and combat service support elements. The BFs established a common framework for designing and implementing performance measurement and after action reviews (AARs).

The Staff Group Trainer Project's training exercises were designed to serve as the "bridge" between individual staff officer skills training provided by the BSTS and the structured unit training provided by simulation-driven exercises developed in ARI's SIMUTA, Simulation-based Mounted Brigade Training (SIMBART) and Combined-arms Operations at Brigade Level, Realistically Achieved through Simulation (COBRAS) Programs (Figure 1). At a macro level, the BFs provided a task-based strategy for staff training and provided objective performance measures for the Staff Group Trainer Project. Thus, the BFs provided the structure to span the training gap from BSTS to Janus-driven exercises with the VTP or FXXITP.

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[2] The term "Battlefield Function (BF)" was designated by the U.S. Army Training and Doctrine Command (TRADOC) in September 1996 to replace "Critical Combat Function (CCF)."

In the ITTBBST Program, the ideal training progression begins with BSTS training to develop the individual's understanding of his staff responsibilities. Staff members then participate in a series of Staff Group Trainer exercises. These dynamic small group training experiences focus on staff processes needed to support the commander's battlefield awareness, recommend courses of action, and support the commander's decisions. The structured messages sets and short situational exercises focus the staffs on intra- and inter-staff processes. Participation in Staff Group Trainer exercises helps prepare staff members for an increased level of interaction and tactical decision-making provided by the Janus or Brigade/Battalion Battle Simulation (BBS) collective training environment.

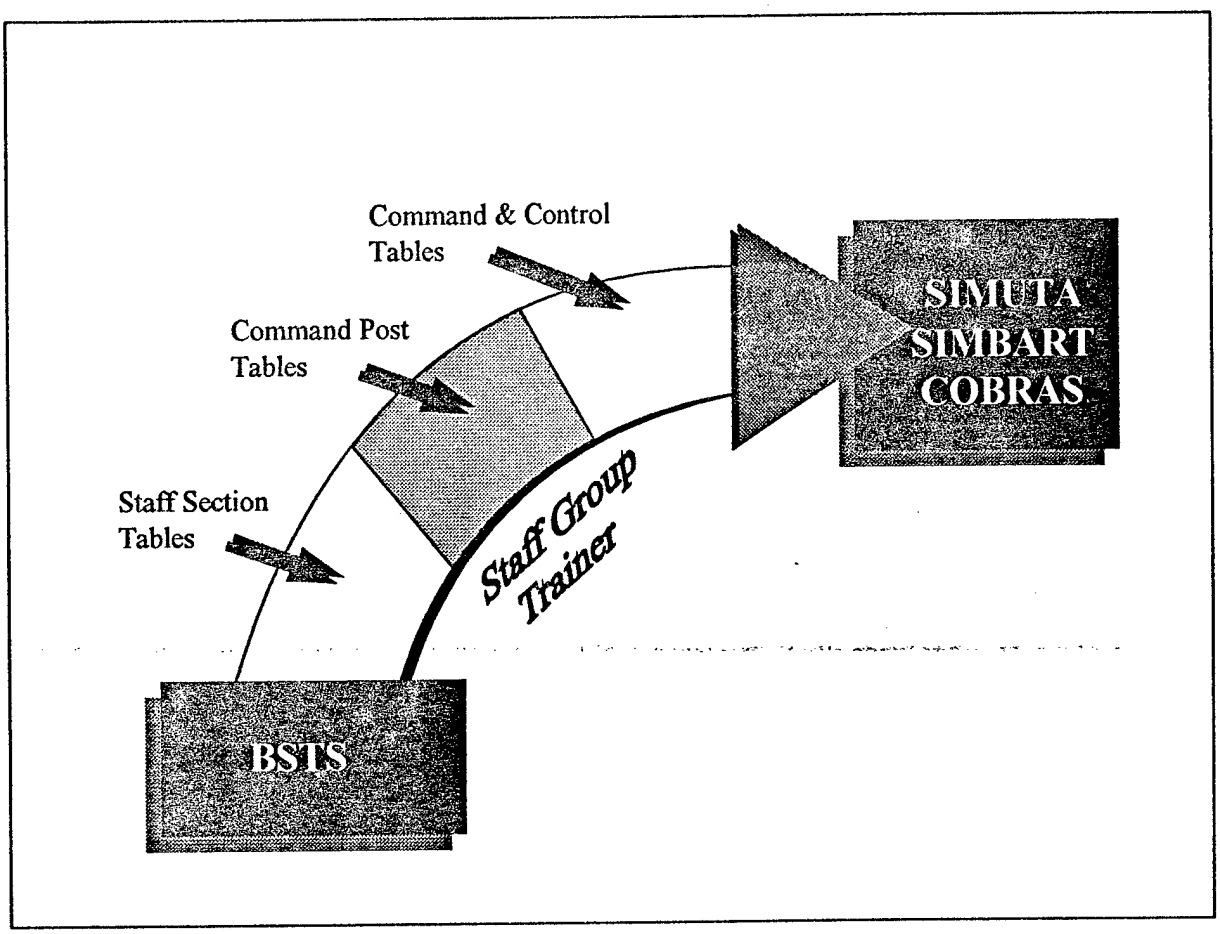

Figure 1. Staff Group Trainer Project training progression.

Review Of Preceding Projects

The Staff Group Trainer Project had its roots in two related areas. The first was the ARI Armored Forces Research Unit (AFRU) research on future battlefield conditions. The second was ARI AFRU research on structured, simulation-based training for mounted forces.

Starting in the late 1980s, the ARI AFRU conducted a series of experiments to evaluate new tools and equipment (position navigation system, command and control display, and commander's independent thermal viewer), which the Army was planning to bring to the armored forces. Much of this research effort fell under the Combat Vehicle Command and Control (CVCC) Program. It began by evaluating each piece of equipment at crew and tank platoon levels (Du Bois & Smith, 1989, 1991; Quinkert, 1990). From crew and platoon levels, the research progressed to evaluating the integrated impacts of all tools and equipment at company level (Leibrecht, Kerins, Ainslie, Sawyer, Childs & Doherty, 1992) and then at battalion level (O'Brien, Wigginton, Morey, Leibrecht, Ainslie, & Sawyer, 1992; Leibrecht, Meade, Schmidt, Doherty, & Lickteig, 1994; Meade, Lozicki, Leibrecht, Smith, & Myers, 1994; Atwood, Winsch, Sawyer, Ford, & Quinkert, 1994). A limited part of the research effort at battalion level focused on the role of the battalion tactical operations center (TOC) equipped with automated workstations (O'Brien et al. 1992). This initial research with automated workstations provided the equipment and impetus to continue investigating an approach for training effective and efficient staff processes.

The second origin of the Staff Group Trainer Project came from research in structured training conducted under SIMUTA starting in 1993 (R. G. Hoffman et al. 1995). The intent of SIMUTA was to provide compressed, turnkey training to units in a simulation environment focusing on the mission execution phase. Unit collective training was developed for tank, mechanized infantry, and scout platoons; tank companies and tank-heavy company/teams; tank battalions and tank-heavy task forces; and tank or tank-heavy battalion/task force staffs. Training materials were developed and packaged as a library of structured simulation-based training exercises which a unit commander could use to meet unit training needs. These exercises came with a complete TSP including a multimedia program orientation and planning materials with complete operation orders (OPORDs) for the units; and job aids, exercise checklists and feedback guidelines for observers to use during preparation, execution, and AARs. The TSP also included guidelines for preparing take home packages (THPs) for units after they complete their training. The SIMUTA program (C. H. Campbell, R. C. Campbell, Sanders, Flynn, & Myers, 1995; R. G. Hoffman et al. 1995) provided a basis for the orders, TSPs, THPs, and structured simulation-based training development methodology of several follow-on programs including the Staff Group Trainer Project.

The C/ST project was part of the SIMUTA program and used CVCC technology as a base. The CVCC TOC workstations were used as exercise drivers and part-task trainers for primary battalion staff. Simulation Networking (SIMNET) acted as a driver for the CVCC soldier-in-the-loop simulations for mission rehearsals, war gaming, execution, and AARs. The C/ST workstations were different from the CVCC TOC workstations in their purpose--training versus research. Since the ARI AFRU wanted training to focus on information processing, the

ARI research team developed four exercises based on the SIMUTA movement to contact scenario. The SIMUTA C/ST hardware/software package established the baseline from which the Staff Group Trainer Project's hardware/software package evolved.

Three preceding projects--SIMUTA, SIMBART, and SIMUTA - Battalion Exercise Expansion (SIMUTA-B)--provided baseline OPORDs and the framework for the tactical structure of the Staff Group Trainer Project's scenarios. They also provided the initial methodology for design and development of training exercises and TSPs.

Problem Statement

As represented in Figure 1, maneuver staffs needed a tool to bridge the training gap between the skills achieved by a primary staff officer who had participated in BSTS training and the collective skills required of an entire battalion or brigade staff using SIMUTA, SIMBART or COBRAS training exercises. The Staff Group Trainer Project development team's front-end analysis indicated this gap should be spanned by a stepped training package. This translated into staff cell training (small groups of individuals from a staff section operating within a CP), CP training, and training of the collective staff operating in multiple CPs. The development team found a need for training emphasis on the staff's synthesis of information and the communication of that information to the commander so that he could use it in his decision-making process.

Technical Objective

The primary objective was to develop and formatively evaluate primary staff and staff/group training modules using the Staff Group Trainer technology at battalion and brigade levels for movement to contact, deliberate attack, and defense missions.

Scope of the Project

The Staff Group Trainer Project developed a battalion and a brigade staff training program. The training programs used a modified SIMUTA C/ST hardware/software package to support delivery of the training. The training approach focused on the performance of individual staff members, staff groups (e.g., Intelligence Officer [S2] and Operations Officer [S3]), and the integration/synchronization of the primary battle staff during the execution phase of the scenarios. Each scenario used the SIMBART and SIMUTA-B orders developed for the VTP. These scenarios were based on at least one battalion operating east to west in the central corridor of the National Training Center at Fort Irwin, California. The enemy forces were the same as those in the SIMBART and SIMUTA-B scenarios and were based on the heavy opposing force units at the Combat Training Centers and in the U.S. Army Training and Doctrine Command (TRADOC) (Department of the Army, 1993b, 1993c). Each exercise took less than an hour of actual execution time. Each was preceded by a preview and preparation phase that did not exceed an hour and was followed by a structured AAR of less than an hour. The training programs included train-the-trainer components, TSPs, and preview and AAR support materials.

Organization of the Report

The remainder of this report contains the following sections:

Design - A description of the training program design including decisions that were made and rationales for those decisions.

Software Development - The methodology and decisions involved in modifying the system software.

Exercise Development - A description of how the exercises were developed, decisions made during the development, and the internal formative evaluation.

Training Support Package Development - A discussion of the process for developing the TSPs, including decisions made and results of reviews of the initial products.

Formative Evaluation - A description of the formative evaluation process followed in the project and a summary of key findings during external tests of the training program.

Lessons Learned - A summary of the most important lessons learned during the project.

Conclusions - The findings and suggestions for continued research.

DESIGN

Design Principles

The Staff Group Trainer Project development team designed the TSPs for the staff to have a high likelihood of success in each exercise. Research in adult learning and staff training support this design objective. Olmstead (1992) pointed out that other researchers (Mills, 1967; Gill, 1977) found that nothing contributed more to greater cohesiveness than a successful action. Thus, the team developed the training programs so that for each exercise, the staff would be challenged but should successfully achieve the exercise's training objectives. Druckman and Bjork (1994) wrote that "self-confidence is a potent predictor of an individual's performance" (p. 202) and that the role of an instructor is "to develop and sustain a learner's high level of self-confidence by ensuring performance success" (p. 202). Jourdan, Bandura, and Banfield (1991) suggest that when first teaching a complex task, a learner's self-confidence beliefs and perception of success are enhanced by emphasizing process-related (learning) goals over outcome-related (performance) goals. Success is redefined to include effort, form, and strategy, rather than winning or losing or number of tasks completed (Jourdan et al. 1991).

Designing exercises that are both challenging and provide a high likelihood of success is a formidable task. The task is to design exercises where the challenge of a task matches the ability of the participants, so that they become absorbed "in the game." This is referred to as "flow" (Martens, 1990). On one side of the "flow" state is frustration because a task is too challenging; on the other side is boredom when the task is too easy (see Figure 2). Within the "flow" state, the training challenges the participant but he experiences success. Martens stated that the participant becomes caught up in or "immersed" in the activity when the "flow" state is achieved. This could

be similar to Brown's (1992) concept of immersion. While designers, developers, and trainers strive to achieve this "flow" state in training, it is complicated because staffs and staff sections are often not at the same level of training. Providing "flow" exercises for all requires a robust training environment. The training matrix conceptualized at the beginning of this project to provide this robustness is discussed later.

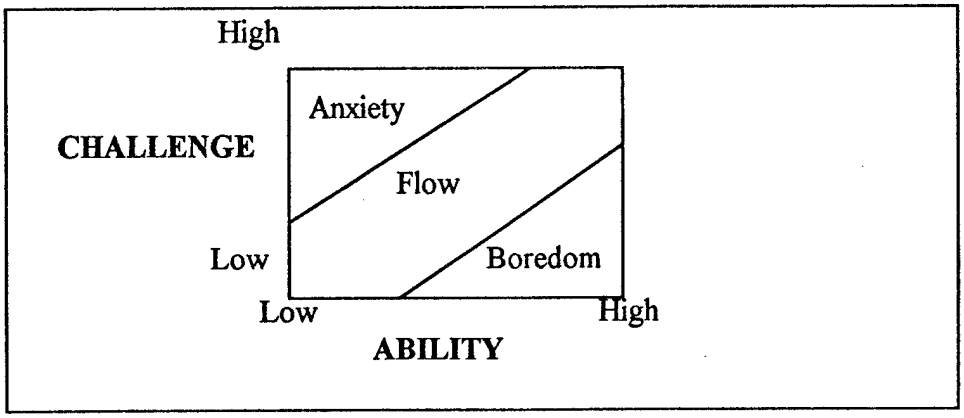

Figure 2. The relationship between challenge and ability: The "flow" experience (This figure is from Martens, 1990, p. 45.).

The development team designed the AARs and trainer instructions so that feedback to the staff focused on performance of staff actions and was provided positively--praising good performance and avoiding harsh criticism of poor performance. During feedback sessions, Johnson and Johnson (1994) emphasized that team members must process how they are functioning as a team, examine what actions were helpful and not helpful, and make decisions about what they want to continue or change.

The development team designed the training to foster team cohesiveness. Training a staff requires staff members to be able to: (a) individually make decisions by processing system-specific knowledge and (b) function as members of a team sharing individual knowledge and conclusions, then processing pooled information into system-wide decisions (Druckman & Bjork, 1994). According to McIntyre and Salas (1995), "tactical teams within the military exist (1) to help a leader assess a given scenario involving imminent danger or threat, (2) to provide information to the leader in a form that he or she can use in making a decision, and (3) to implement the action implied by the decision that the leader comes to" (p. 9). Orasanu and Salas (1993) discussed a concept of "shared mental models." A shared mental model is organized knowledge shared by team members who work together over relatively long periods of time. According to Orasanu and Salas (1993, p. 7), "such knowledge enables each person to carry out his or her role in a timely and coordinated fashion, helping the team to function as a single unit with little negotiation of what to do and when to do it." U.S. Army doctrine establishes a basis for a staff's "shared mental model" (Department of the Army, 1988a; 1988b; 1988c; 1988d; 1992; 1993d). The Staff Group Trainer Project development team designed the TSPs so that leaders would reinforce this model. Orasanu (1990) found that leaders of high-performing teams stated

more plans, considered more options, provided more explanations, and sounded more warnings or predictions. The TSP design concept was built on this research background and Army doctrine, and it formulated conditions to guide the staff to develop a "shared mental model." The development team also established training objectives that emphasized process-related goals (Jourdan et al. 1991).

To embed these design concepts in the TSPs, the development team designed the TSP to allow leaders to communicate expectations for what was required from the staff/sections prior to the start of an exercise. Thus, at the start of an exercise, leaders communicated plans, options, explanations, warnings, and predictions for the exercise. Because of leader involvement in the training, leaders could reinforce or expand upon what they wanted to see during exercise execution. Because training exercises portrayed a unit successfully conducting its mission, the development team provided message traffic to the staff that showed subordinate units were successful. During each exercise, the training staff had a high likelihood of achieving the training objectives. To further encourage this, the basic message list from the subordinate and higher units or staffs provided an accurate and timely picture of the battlefield. Messages were regulated so that the staff had adequate time to perform required tasks.

The development team designed the AAR to focus on processes and what did and did not work. As suggested by Johnson and Johnson (1994), observers facilitated the staff formulation of what to continue (sustain) or change (improve).

Training Concept

The Staff Group Trainer Project plan was based on an analysis of the training gap between BSTS and collective Janus or BBS exercises. The development team examined results of the SIMBART trials (a structured Janus brigade staff exercise), the SIMUTA Janus trials (structured Janus battalion staff exercises), BSTS courses, and the SIMUTA C/ST exercises. They determined that SIMUTA C/ST exercises would not provide the staff sections and CPs the interactive train-up they would need prior to a Janus or BBS exercise.

As a result of this analysis, a new concept emerged, involving more than the primary staff officers. The training became oriented toward the staff section, the CP, and the unit staff as a synergistic team. For this effort, the development team adopted the definition of "team" used by Morgan, Glickman, Woodard, Blaiwes, and Salas (1986, p. 4), "...a distinguishable set of two or more individuals who interact interdependently and adaptively to achieve specified, shared, and valued objectives." This shift in focus was the impetus to change the project name from C/ST to Staff Group Trainer.[3] The revised Staff Group Trainer concept highlighted how staff officers would evaluate the information and make decisions on mission impact, and then take action on their analysis. The new concept expanded the training audience to include at least two additional members per section. These individuals assisted and freed that section's officer to perform the

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[3] Although not actually adopted until this project was underway, the term Staff Group Trainer will be used for the project from this point forward. This highlights the change in focus from the SIMUTA C/ST project.

higher order staff tasks and interact with other sections as the training expanded into a decision-making exercise.

The TSP structure was organized in tables. Tables consisted of several modules, each containing several exercises. Figure 3 illustrates the battalion TSP, while Figure 4 illustrates the brigade training program. The entry point for all staff sections was their first exercise in the staff section table. Each section had its own module consisting of two exercises. In the battalion program, the section modules were conducted concurrently. In the brigade program, the main CP and tactical command post (TAC CP) section modules were conducted concurrently. The rear CP modules were conducted at a different time because there were not enough workstations to conduct all sections concurrently. For both the battalion and brigade TSPs, each CP had its own training module. Both the brigade and battalion TSPs contained three exercises per CP module. The C^2 tables in both programs consisted of three modules--movement to contact, deliberate attack, and defense (battalion defense in sector and brigade area defense) missions. In the battalion TSP both CPs participated in each module. Each module in the battalion TSP consisted of four exercises. In the brigade TSP only two of the three CPs could participate in each module. The command group and TAC CP participated in the movement to contact module. The main and rear CPs participated in the deliberate attack module. The TAC and Main CPs participated in the area defense module. Each module in the brigade program consisted of two exercises.

The remainder of this chapter discusses the program design in terms of the training audience, the training system (hardware and software), training objectives, evolution of the training matrix, the training team, and phases of an exercise.

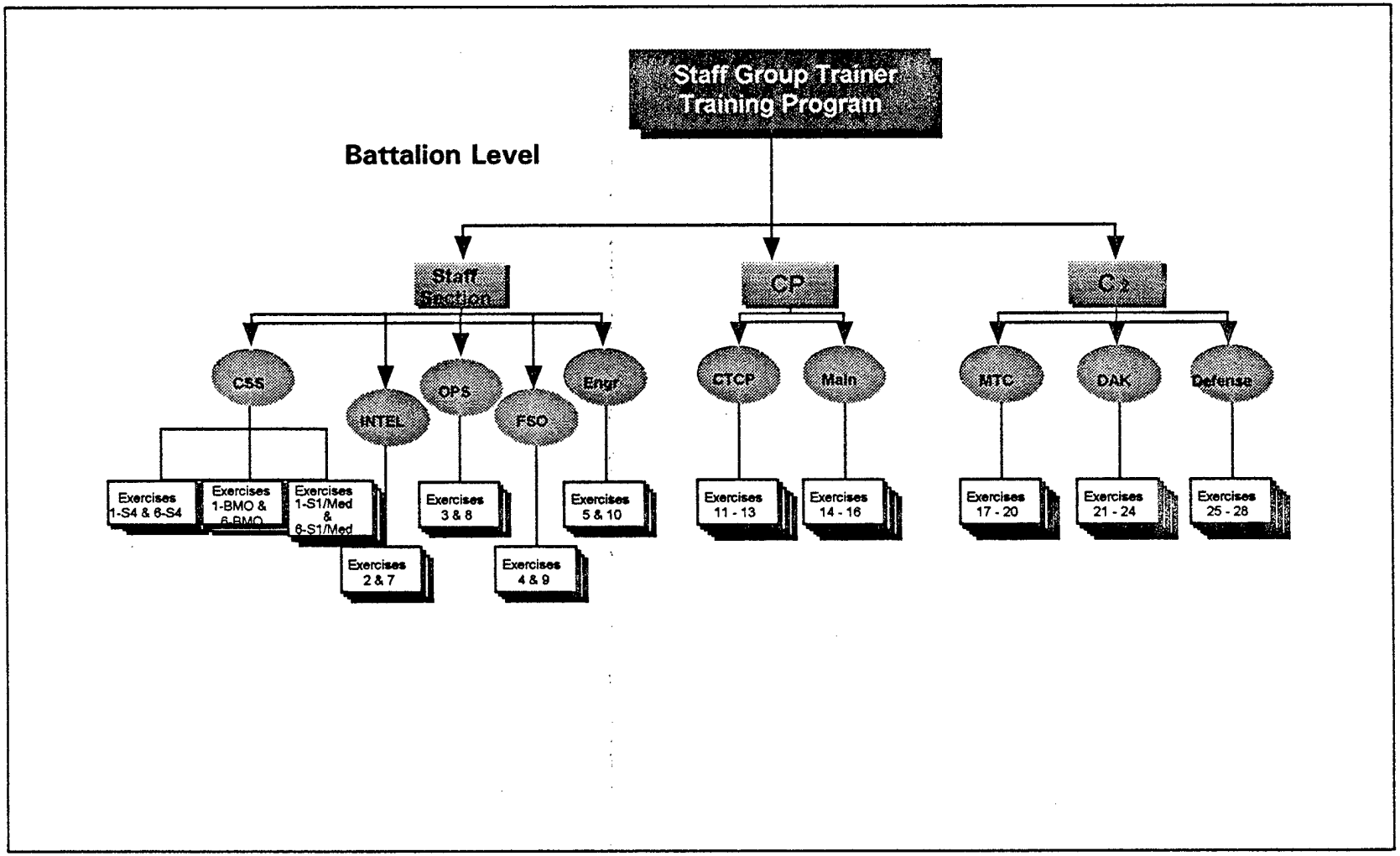

Figure 3. Battalion training program

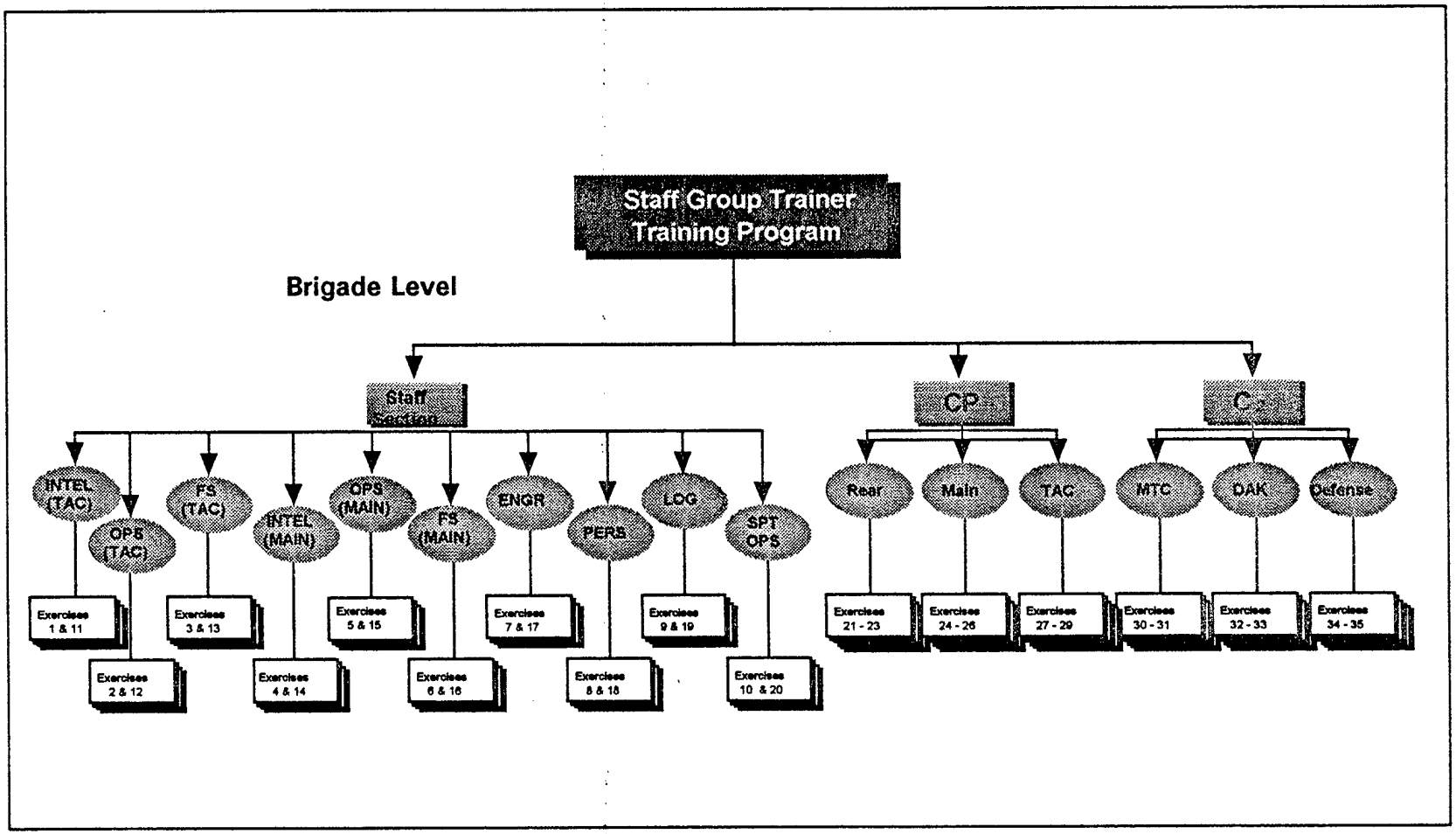

Figure 4. Brigade training program

Training Audience

The development team designed each TSP for a staff initially at a "crawl" level of training. Such a staff would be inexperienced in working with one another or be having difficulty working together. This does not imply that individual staff members would be untrained but that, as a collective section, the staff is at the "crawl" level of their training. In fact, each staff member was assumed to be knowledgeable of his job. The development team profiled the training audience as members of an active or reserve conventional heavy maneuver battalion or brigade staff. A conventional unit was one equipped with fielded digital equipment (i.e., current maneuver control, field artillery, intelligence, and combat service support systems) but no experimental digital equipment. The training audience was defined as individual staff members, staff groups (e.g., members of the S2 and S3 sections), and primary battle staff. The training audience includes those staff members who routinely work in one of the unit's CPs—see Table 1 and Table 2. The commander and the S3 are not included in this training audience. The commander and the S3, but especially the commander, are involved in the TSPs as trainers and unit standard setters.

Table 1

Battalion Training Audience

Command Post	Section	Training Personnel
		Executive Officer (XO)/Battle Captain (BC)
		Assistant S3
	Operations Section	Operations Non-Commissioned Officer (NCO)
		Operations Assistant
		S2
Main Command Post	Intelligence Section	Intelligence NCO
		Intelligence Specialist
		Fire Support Officer
	Fire Support Element	Fire Support NCO
		Fire Support Specialist
		Engineer Officer
	Engineer Section	Engineer NCO
		Engineer Specialist
	Logistics Section	Logistics Officer (S4)
		Supply NCO
Combat Trains Command Post	Personnel Section	Personnel Officer (S1)
		Assistant Personnel Staff Non-Commissioned Officer (PSNCO)
	Battalion Maintenance Section	Maintenance Officer/NCO
		Maintenance Administration Specialist
	Medical Platoon	Medical Officer/NCO
		Medical Administration Specialist

Table 2

Brigade Training Audience

Command Post	Section	Training Personnel
Tactical Command Post	Operations Section	S3 (Officer in Charge [OIC]) S3 Air Assistant Operations NCO Operations Assistant (optional)
	Intelligence Section	Tactical Intelligence Officer Senior Intelligence NCO
	Fire Support Element	Assistant Fire Support Officer [FSO] Fires Support Specialist
Main Command Post	Operations Section	XO or Battle Captain Assistant S3 Operations NCO Operations Assistant S4 Representative
	Intelligence Section	S2 Intelligence Sergeant Assistant S2
	Fire Support Element	Fire Support Officer Fire Support NCO Fire Support Assistant
	Engineer Section	Engineer Officer Engineer NCO
	Logistics Section	S4 Senior Supply NCO
Rear Command Post	Personnel Section	S1 Medical NCO PSNCO
	Support Operations Section	Forward Support Battalion (FSB) Operations Officer Assistant FSB Operation Officer

Training System

Initially the Staff Group Trainer hardware suite consisted of six Sun SPARC workstations linked by a local area network (LAN). Two workstations were added later in the project. Each workstation consisted of two 19-inch color monitors, a keyboard, a processor, and a mouse. A military tactical map was displayed on the left-hand monitor. A message display was on the right monitor. One workstation was used to control the exercise. When an exercise was executed, this workstation sent pre-scripted messages from the exercise message database over the LAN to the other workstations. One or two workstations were allocated for support personnel role-playing subordinate units or staffs and higher headquarters. The remaining workstations were allocated across the staff positions. The system also had a large screen monitor that was used to display the main CP's situation map. Each staff section in the main CP could update information to this situation map.

The allocation of workstations varied depending upon what staff positions were trained in a given exercise. These workstations emulated the staff section's mapboard, staff journal, files, and all forms of communication devices the staff section might have (i.e., radios, faxes, telephones, fielded digital systems, etc.). The messages from the control station were addressed to specific stations (i.e., S2, commander, etc.). Each workstation displayed only the messages (a) addressed to the staff section using the workstation or (b) available via network distribution. The LAN permitted staff members at the different workstations to exchange information. Additional reports could be created and received.

The two main components of each workstation were the tactical map display and the message display. The map display gave each staff section the ability to tailor the map's scale and features to meet their needs. The section could create, display, and edit various operational overlays on the map display. This enabled the staff section to maintain the same type of map-based information as they would in a CP. The message display indicated incoming reports and allowed the section to open a message to read its contents. Messages were displayed in standard message formats. The staff section could also store, recall, compose, transmit, forward, and annotate messages on the workstation.

The team developed software modifications to enhance some of the functional features and to make the system more reliable and easier to use. These modifications are discussed in more detail in the software development section.

Training Objective Development

The training objectives for the Staff Group Trainer represented an evolution from the work completed within the SIMBART program and incorporation of the BF analyses.

The SIMBART development team devised a means of focusing on staff activities that supported the commander's decision points (Koger, Long, Britt, Sanders, Broadwater & Brewer, 1996). The team drew heavily on Olmstead's (1992) adaptation of Schein's (1965) adaptive-coping cycle which looked at organizational process. Schein (1965) suggested this cycle as a sequence of activities used by organizations in adapting to changes in their environments.

Olmstead (1992) adapted this cycle to identify, isolate, and evaluate staff processes. Olmstead's adaptation is shown as the inner cycle in Figure 5. The SIMBART cycle is the second ring in Figure 5. The SIMBART team referred to this as "greening" or changing the terminology to Army terms rather than academic terms. The SIMBART development team established an observation and feedback system that focused on these staff processes, and although some difficulties arose with the implementation during the pilots and trial, the design was an effective way to quantify staff performance.

The Staff Group Trainer Project development team focused on training the staff to meet the commander's needs on staff processes and products. The development team also examined the BFs. The BF analyses fit well into the staff process model developed in SIMBART. With a few changes and adjustments, the development team modified the SIMBART cycle into the cycle shown as the outer ring in Figure 5. This cycle defined the training objectives for the exercises.

The training objectives evolved as the project matured. Initially, only five training objectives--process, analyze, coordinate, integrate, and recommend--were listed in the training program. By the end of the project design phase, all ten training objectives were included in the program. Table 3 shows the training objectives as they appeared in the final TSPs.

Training Matrix Evolution

The concept for the project's training matrix originated with Lieutenant General Frederic Brown (Retired) at the SIMUTA proof-of-concept test when he referred to C/ST as the "staff conduct-of-fire trainer (COFT)" . The development team conceptualized a matrix that progressed from the staff section to CP and then to the staff in multiple CPs. This sequence enabled individual staff officers to progress from individual tasks to full staff exercises. This conceptual matrix became the foundation for the design and development of each training program. Each block in the matrix represented a single exercise. The version, shown in Figure 6, bears a similarity to the unit COFT training matrix (General Electric, 1985). There were three dimensions--training complexity (X-axis), mission complexity (Y-axis), and simulation intensity (Z-axis).

Training objectives became more complex from the staff section table to the C^2 table along the X-axis (from left to right in Figure 6). In Tables 4 and 5, the training objectives are ordered in the left column. These tables illustrate the progression within the battalion and the brigade programs, respectively. Note that early exercises focused on first training objectives--monitor, process, and analyze--while the C^2 table focused on later training objectives of direct, synchronize, and disseminate.

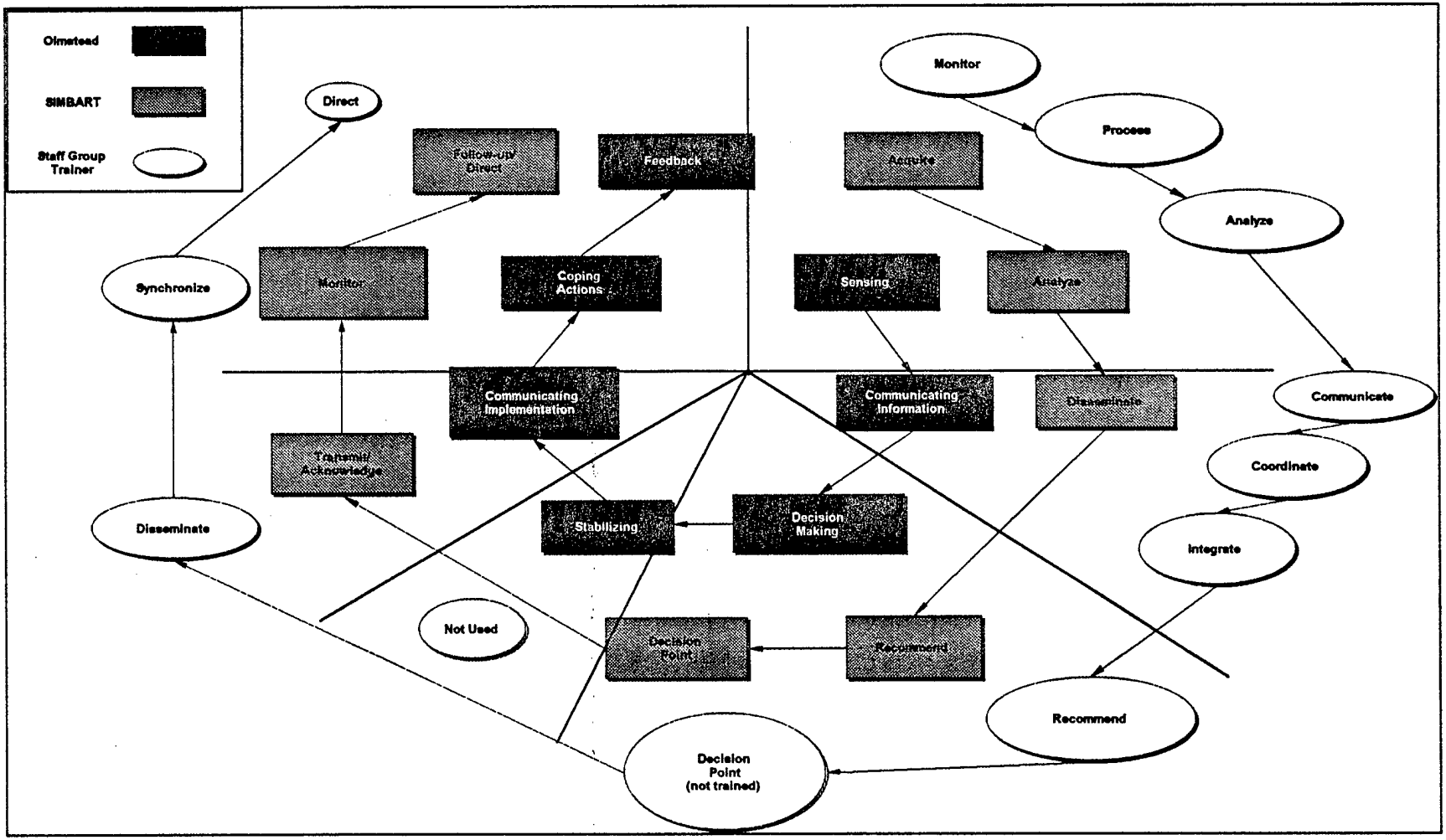

Figure 5. Evolution of the staff support cycle.

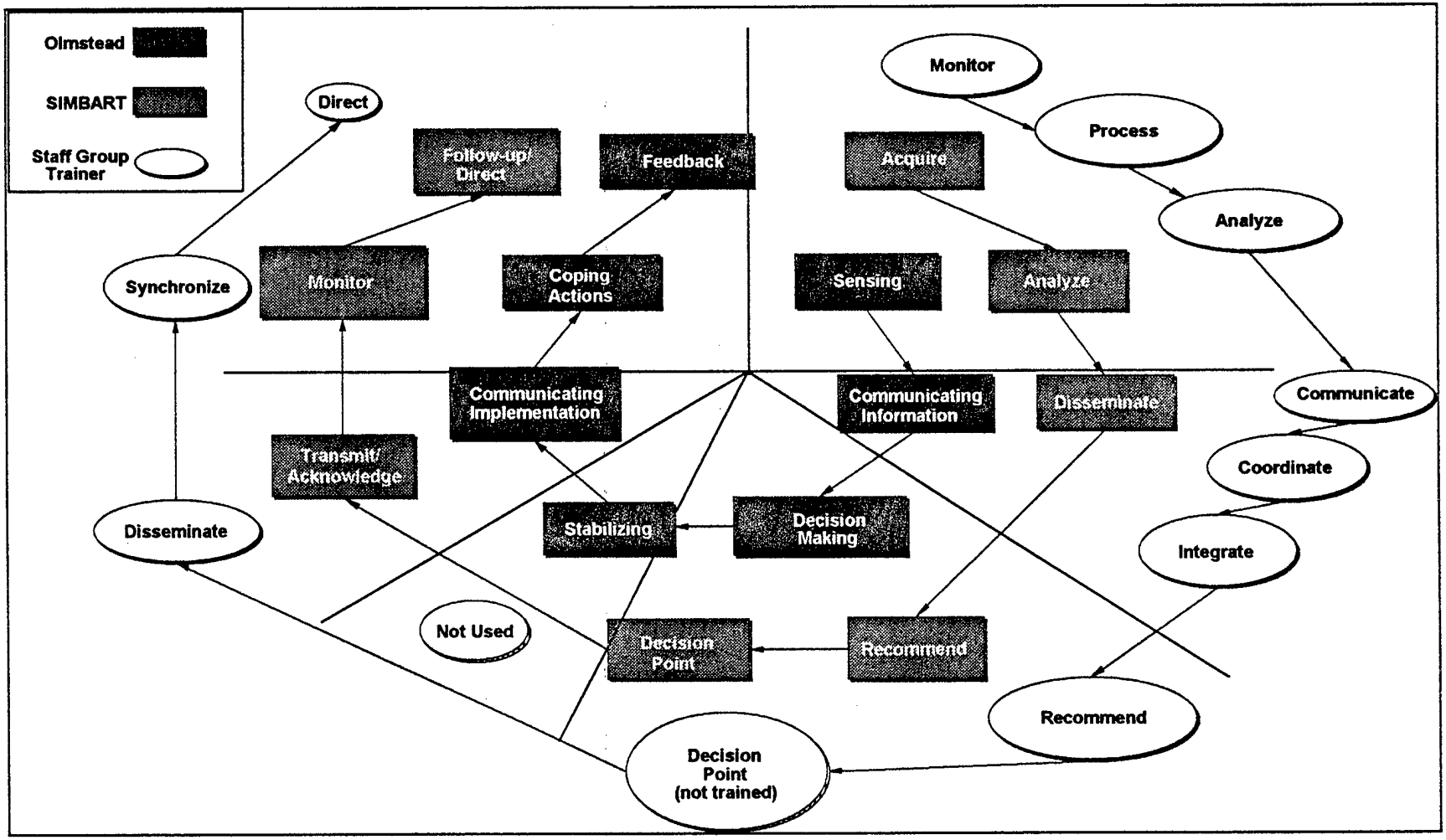

Figure 5. Evolution of the staff support cycle.

Table 3

Training Objectives for Battalion and Brigade Training Programs

Training Objective	Description
Monitor unit operations	**Each section** actively seeks information about • higher, • adjacent, • support and • subordinate units. **Each section** acquires information by listening to reports and asking for needed information.
Process information and messages	**Each section** • collates, • transforms, and • organizes information. **Each section** stores information on • maps, • situation boards, • journals, and • files. All information can be retrieved and used.
Analyze/evaluate information	**Each section** attaches meaning, either speculative or confirmed, to information that has been acquired.
Communicate mission critical information	**Each section** transmits information or intelligence to those who must make decisions about or act on it. This includes initial transmittal of sensed information; relaying; and disseminating throughout the • staff, • command posts, • subordinate units, • supporting units, and • higher headquarters.
Coordinate information and intelligence	**Each section** exchanges and discusses information and intelligence with others outside the section to clarify meaning and determine implications.
Integrate staff input	The **XO/BC** aids the commander's battlefield awareness by: combining information and intelligence from all staff sections, putting information and intelligence into a useable format, and passing information and intelligence to the commander. The **XO/BC** identifies areas requiring staff sections to combine efforts to support the commander's intent.
Recommend a course of action	**XO/BC** and **staff sections** develop and analyze courses of action. **XO/BC** recommends a course of action to the commander.
Disseminate commander's decision	The **staff** prepares and issues orders or fragmentary orders (FRAGOs) to inform units and staff of commander's decision.
Synchronize activities of subordinate and supporting units.	The **XO/BC** and **each section** monitor unit and Battlefield Operating Systems (BOS) assets to ensure their efforts are aligned to execute the commander's intent or direction.
Direct BOS assets to support commander's intent	The **XO/BC** and **each section** track activities of BOS assets and intervene, if required, to ensure their activities support the commander's intent.

The Y-axis of the matrix (the vertical axis in Figure 6) represented the complexity of the program's three missions. When the development team analyzed these missions for complexity of staff actions, they ranked the three missions from simplest to most complex as follows: movement to contact, deliberate attack, and defense.

The Z-axis (the front-to-back axis in Figure 6) represented simulation intensity. The original idea was to vary not only the number of messages but also the type of information and accuracy. There would be three different message lists--one with only critical messages, one with critical messages and other messages that were not critical for the section, and one with critical messages, non-critical messages, and inaccurate messages. Progressing along the Z-axis would have meant that the staff would have to deal with increasing numbers of messages, as well as an increase in complexity of analysis because of changes in the message value and accuracy. In the delivered exercises, only accurate messages were included although the list did contain both critical and non-critical messages. Only accurate messages were included because the development team was concerned with the workload at each workstation.

For this project, the team did not develop TSPs for the entire matrix. The unshaded blocks in Figure 6 indicated exercises the development team proposed to complete in this project. The unshaded blocks represented a possible progression a unit would take through the matrix to complete the training. Figures 3 and 4 (presented earlier) showed the delivered programs. The exercises in these programs corresponded to the unshaded blocks. Although the conceptual matrix indicated multiple entry points, the delivered training programs had one entry point. The staff's progress through the matrix would be determined by its performance in an exercise. Exceptional performance would take the staff into more challenging exercises. Poor performance would result in a remedial exercise. The staff would progress to the next table only after successful completion of the gate exercise. Since the entire matrix was not developed and the development team was concerned with the workload at each workstation, the developed exercises contained only accurate messages.

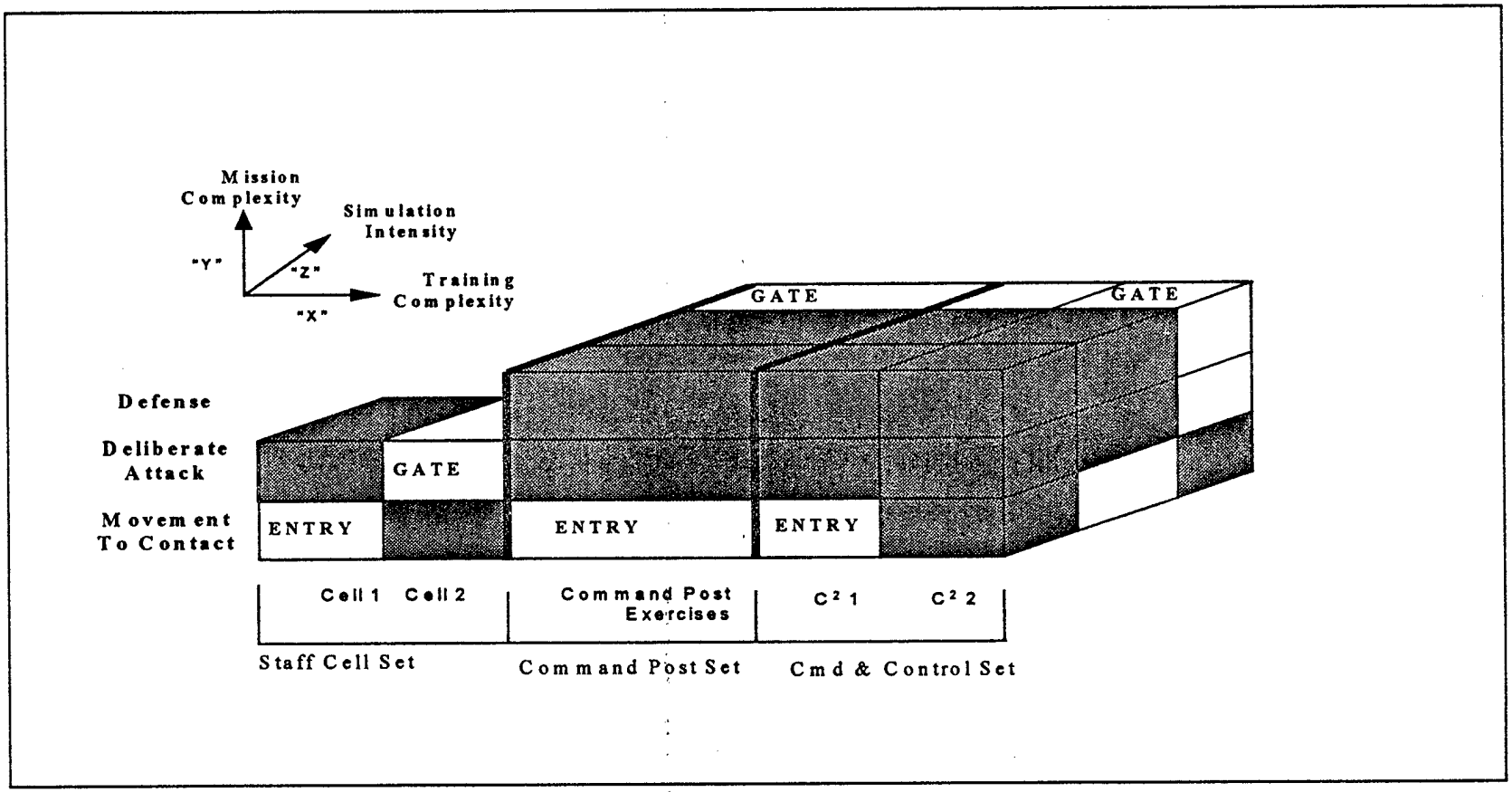

Figure 6. Training matrix.

Table 4

Battalion Program - Training Objectives for Each Exercise

	Section Table		Command Post Table			Command and Control Table			
Training Objective	First Exercise	Second Exercise	First Exercise	Second Exercise	Third Exercise	First Exercise	Second Exercise	Third Exercise	Fourth Exercise
Direct									F
Synchronize									F
Disseminate								F	F
Recommend					F		F	F	O
Integrate				F	F	F	F	F	O
Coordinate				F	F	F	F	F	O
Communicate				F	O	F	O	O	O
Analyze		F	F	F	O	F	O	O	O
Process	F	O	O	O	O	O	O	O	O
Monitor	F	O	O	O	O	O	O	O	O

F - Focus of this exercise

O - Training objective previously focused upon, now observed only

Table 5

Brigade Program - Training Objectives for Each Exercise

	Section Table		Command Post Table			Command and Control Table	
Training Objective	First Exercise	Second Exercise	First Exercise	Second Exercise	Third Exercise	First Exercise	Second Exercise
Direct							F
Synchronize							F
Disseminate							F
Recommend					F	F	F
Integrate				F	F	F	F
Coordinate				F	F	F	O
Communicate				F	F	F	O
Analyze		F	F	O	O	O	O
Process	F	O	O	O	O	O	O
Monitor	F	O	O	O	O	O	O

F - Focus of this exercise

O - Training objective previously focused upon, now observed only

Training Team

The framework for the TSP design was not tied to the organization and functions of a specific training team.[4] The development team configured a training team composed of 12 trainers for the battalion program (Table 6) and 15 trainers for the brigade program (Table 7). The following paragraphs summarize the role of each training team member.

Table 6

Battalion Training Team

Title	Quantity
Exercise Director	1
Senior Observer (Main Command Post)	1
Intelligence Section Observer	1
Operations Section Observer	1
Fire Support Element Observer	1
Engineer Section Observer	1
CTCP Observer /Logistics Section Observer	1
Personnel/Medical Section Observer	1
Maintenance Section Observer	1
Interactor	2
System Administrator	1

Exercise Director

The exercise director worked with the unit commander before, during, and after the exercise. The director assisted the commander by helping him focus on important issues that occurred and ensuring that the training team brought important information on staff performance to the commander's attention during execution. The TSPs contained materials that the exercise director used to assist the commander.

System Administrator

The system administrator initialized the training system and loaded the exercises. During the exercise, he ensured that the messages were properly sent to the workstations and took immediate action should any problems occur. After the exercise, the system administrator sent the end-of-exercise (ENDEX) materials to all the workstations and prepared the system for the AAR process.

[4] The training team has been referred to as an observer/controller (O/C) or observer/controller/interactor (O/C/I) team in other programs. This project used the term "training team" to reflect the team's training focus.

Table 7

Brigade Training Team

Title	Quantity
Exercise Director	1
Senior Observer/Main CP Observer	1
Intelligence Section Observer (Main CP)	1
Operations Section Observer (Main CP)	1
Fire Support Element Observer (Main CP)	1
Engineer Section Observer (Main CP)	1
TAC CP Observer/Operations Section Observer (TAC CP)	1
Intelligence Section Observer (TAC CP)	1
Fire Support Element Observer (TAC CP)	1
Rear CP Observer/Logistics Section Observer (Rear CP)	1
Personnel Section Observer (Rear CP)	1
FSB Support Operations Section Observer (Rear CP)	1
Interactor	2
System Administrator	1

Interactors

. . Interactors role-played as higher, lower, and adjacent staffs communicating with the training audience. During the exercise, the interactors responded to message traffic not addressed to the training audience. They kept the exercise director and commander apprised of how the staff was keeping higher and lower headquarters informed of the battle.

Command Post Observers

One person served as the observer in the Main CP. In the TAC CP, Rear CP, and CTCP, the CP observer also observed one of the sections. The CP observer monitored the interaction between the sections within the CP. After each exercise, he discussed his observations with the officer charged with the CP's operation. The CP observer in collaboration with the exercise director facilitated the end-of-module AAR.

Staff Section Observers

The training team included a dedicated observer for every section in each CP. This arrangement ensured that each section was observed and given feedback at the end of every exercise. Individual section observers were most important during the initial tables where the focus was on the staff section's performance of the initial training objectives.

Exercise Phases

The project design organized the exercises into phases to facilitate exercise development and administrative control during execution. These phases began when a unit was at the site and had made its preparations for conducting the training. Each exercise was broken into four phases:

- Exercise preview,
- Exercise preparation,
- Exercise execution, and
- AAR.

The following sections discuss each phase and its design basis. The methods for developing the indicated materials are discussed in the exercise development section.

Exercise Preview

Brown (1992) wrote that setting the context for a battle command staff training exercise would be a significant implementation challenge. His goal was to have the staff immersed in the battle context in 30 minutes or less. He suggested that a unit staff would have to be knowledgeable about both the general situation and the specifics necessary for "each individual staff officer and small staff team to fit in to a fast moving situation" (Brown, 1992, p. 3-8). Brown envisioned the general situation summary to be far easier than the specific situation to present to a staff. He anticipated the specifics to be the most challenging to present, but to have the "highest potential for training applications" (p. 3-9).

The project development team's analysis aligned closely with Brown's (1992). They envisioned the general situation summary to be a short battle summary to the entire staff, consisting of:

- what had led up to this point in the battle,
- what to expect in the exercise, and
- the exercise training objectives.

The developers designed the general situation summary to be conducted by the exercise director or senior observer using a map with appropriate overlays. The commander could tell his staff what he expected from them during the exercise. The commander's expectations consisted of the critical pieces of information he needed from the staff or the fact that he wanted the staff to make a recommendation based on their analysis of the situation when a decision point was reached. This approach was based on Orasanu's (1990) findings on leaders of high-performing teams and reinforced the "shared mental model" concept discussed by Druckman and Bjork (1994). The developers allotted 10 minutes for the general situation summary and the commander's instructions. The developers also prepared a multimedia presentation of the general

summary for several modules to demonstrate an alternative approach to delivering this portion of the preview.

The specific situation was more challenging to prepare and present to the unit. The design was structured so each section observer could present a separate section preview including updated information or charts, overlays, journals, etc. and a verbal section-specific situation update. The section observer was required to highlight the portion of the decision support template (DST) and execution matrix specific for the section and any other section specific requirements. The section leader was allowed time to highlight his needs, other staff section needs, and his commander's needs. These needs were derived from the section leaders' analysis of the DST, execution matrix, and guidance provided by the XO/BC. This highlighting of needs further supported the "shared mental model" concept. The exercise TSP provided each section observer with his briefing and all exercise material for his section. The section observer was allotted about 10 minutes for his preview. The delivery of the preview was vital for the unit to achieve maximum training benefit.

Preparation

After the staff was immersed in the situation, they were given time to prepare for the exercise. This included posting maps, updating charts, and coordinating on anticipated actions for the exercise. During this phase, the staff and staff sections had to converge their action plans with the specific situations presented in the previews. R. G. Hoffman et al. (1995) found that units participating in the SIMUTA structured training exercises took more time than had been allocated for the preparation phase. In this program, the developers allotted approximately 10 minutes for the unit to complete their preparation. Although this was an important phase, the development team recognized more time could be used than was allotted. Therefore, they instructed the training team to push the staff to complete preparations within the allotted time.

Execution

The structured training design required that a staff be provided with cues during execution. The quality of training was directly related to the number, timing, and fidelity of these cues. During execution of an exercise, there were three sources of cues: the system (or interactor), the training team, or the staff. Two of the three were controlled by the system or the training team. For the staff created cues, the TSPs provided instruction to the training team to control those cues that detracted from the training.

System or Interactor Created Cues

Messages from the message database were the primary means of providing cues to a staff. These messages provided all the critical information coming from outside the staff. The number, timing and fidelity of messages were critical. Fidelity required doctrinally accurate and situationally correct message traffic. Messages were presented in an expected format, i.e., according to established Army procedures. Enough messages were presented to the staff to ensure that they could achieve the exercise training objectives. The messages were delivered so that staff members were not overwhelmed. Inherent in the message delivery rate was the time

required for the staff to accomplish the training objectives. For example, when the staff section received key messages, it must have sufficient time to analyze and communicate its analysis with other staff sections. The development team designed the system so that: message formats replicated standard formats, the number of messages was sufficient to provide the necessary detail but not overwhelm the staff, and the exercise director could change the delivery rates based on the staff's performance.

Coaching

In the SIMUTA and SIMBART programs, observers did not follow the instructions concerning coaching the training unit (R. G. Hoffman et al. 1995; Koger et al. 1996). Shlechter, Bessemer, Nesselroade, and Anthony (1995) found that observers coached more during a unit's early SIMNET training than in later training exercises. However, coaching incidents were below the developer's expectations (R. G. Hoffman et al. 1995). Hoffman attributed part of the problem to the need for systematic guidelines for each observer. The Staff Group Trainer Project development team incorporated such guidelines in observer checklists. For each exercise, the development team inserted coaching questions for each key event.

Within a given training exercise, the development team identified one or more "teachable moments" (i.e., specific, sometimes intense, points within a given scenario that offered particularly valuable opportunities for learning to take place). As a unit conducted an exercise, each staff section responded to message *cues* that replicated the traffic precipitated by the flow of battle. *Processing* those messages amounted to the mission-specific action that was required of the staff member (e.g., update the enemy situation based on a report of enemy vehicular movement). The *outcome* that the observer was prompted to look for was grounded in the BFs that were aligned with a given staff cell or section. As appropriate, the senior observer could pause the exercise momentarily, without any staff member leaving his position at a workstation, and use the directed questioning approach to cause the staff to think about actions previously taken, or impending actions. Each observer also could use this directed questioning approach to cause his section to think about its actions. The exercise did not have to be paused to use the directed questioning approach.

This technique of presenting one or two focused, reflective questions at set points in an exercise encouraged staff sections and individuals to think about critical aspects of their performance. No answer was necessary, and the exercise continued. Coaching occurred at the workstation, limited distractions, sped the exercise, and challenged staff members to consider information referenced during the end-of-exercise AAR.

Each observer's coaching questions focused his attention during the exercise and in structuring the AAR. During the AAR, he obtained comments from the section that promoted self-discovery learning. By preparing expected responses to each rhetorical coaching question, the development team created an "a-way" (Brown, 1991) for comparison to the unit's performance. Brown's "a-way" is not a "school solution." It is a way that a successful staff performed in the same situation. In this program, this was the way the development team thought a successful staff may have performed.

After Action Review

One level of AAR for all tables and an additional level for CP and C^2 tables was designed. The first was the section end-of-exercise AAR that provided each section immediate feedback on its performance. The staff section observer conducted these at the section's workstation after the exercise. The second was the end-of-module AAR. The senior observer or exercise director conducted this at the end of CP and C^2 table modules. The end-of-module AAR focused on CP or staff processes and interactions. Both AARs were structured to facilitate observer objectivity.

Section End-of-Exercise After Action Review

The section end-of-exercise AAR was divided into several components: staff section self-assessment, previous action plan review, message handling review, overlay comparison, execution discussion, battle tracking discussion, staff support process model (this model is described later in this section) discussion, section action plan preparation, and coordination with other staff sections. Observers completed the end-of-exercise AAR within 30 to 60 minutes, depending on the complexity of the exercise and the needs of the staff section. To start the AAR, the observer reviewed the purpose of the exercise and the staff section's action plan from the previous exercise, helped the staff section focus on the key performance issues from this exercise, and then helped the staff section determine areas needing improvement. This design had each observer facilitate the staff section's decisions on what to continue (sustain) or change (improve) as suggested by Johnson and Johnson (1994). The observers emphasized process-related training objectives as recommended by Jourdan et al. (1991). The emphasis was not on what decisions or actions the staff made but rather on how decisions were reached or how the actions were taken.

Self assessment. At the end of an exercise, the observer gave the staff section an end-of-exercise action plan worksheet (Figure 7) listing objectives specific to the section. The section as a group rated itself on each objective and explained why they rated themselves as they did. Each training objective listed expected activities for the staff section that were keyed to the exercise.

Training objectives, tasks for the exercise, and action plan review. The observer reviewed the training objectives, exercise tasks, and section's last action plan. The purpose of this review was to clarify the focus during the AAR.

Review of message handling. A message summary review and staff journal review were designed to give a quick synopsis of what the section did with all messages that came through the workstation during the exercise. The focus was not on message content but whether the staff opened and read the message and then took action.

Training Objectives Expected Activities		Self Assessment		Action Plan
		Rating	Comments	
1	**Integrate** • Time/distance approach of enemy w/ Bde plan			
2	**Recommend** • Course of action re counterattack (CATK) plan DERBY			
3	**Disseminate** • Cdr's decision re CATK plan DERBY			

Figure 7. Intelligence section end-of-exercise action plan worksheet - Brigade Exercise 34.

Review of battle tracking. On the workstation, the observer brought up the ENDEX overlay and the section's overlays, and provided the ENDEX charts from the TSP. These charts contained information the staff section should have tracked during the battle (i.e., unit strengths and locations, enemy strengths and locations). The observer provided the staff section with the starting information at the beginning of the exercise. He and section members then compared the overlays and charts for agreements and differences and determined causes and ways to correct any differences.

Observer checklist discussion and staff support process model review. Each observer's checklist was designed for his section and exercise observed. This checklist had key messages the section received, expected staff actions on these messages, and coaching questions for each expected staff action. The observer used the coaching questions to facilitate staff section discussion. The staff support process model was a graphic depicting the relationship of a key event to all expected staff actions during the exercise. This was used during the discussion on expected staff actions. The discussion assisted the staff section to decide how to sustain or improve its performance during the next exercise.

Action plan development. Observers reviewed the previous action plan with the staff section. The section evaluated how it did on that plan. The observer facilitated the section's preparation of an action plan for the next exercise.

Coordination with other staff sections. Staff section members communicated with other staff sections to work out areas of needed coordination discussed during the AAR.

Staff Leader Discussion

While staff sections conducted their end-of-exercise AARs, the commander, exercise director, senior observer, and XO/BC discussed how the commander's information requirements were met during the execution. This discussion's purpose was for the commander to assist the XO/BC in understanding the commander's, higher headquarters', and subordinates' information requirements, and for the commander and senior observer to provide feedback on how well the XO/BC were filling those needs. (Figure 8 is an example of the commander's job aid supporting the discussion.)

AD Module Unit Commander's Observations Worksheet

Exercise	What I need from my staff	What I got from my staff
34		
35		

Figure 8. Commander's observations worksheet - Brigade Exercise 34 and 35.

End-of-Module After Action Review

An End-of-Module AAR was designed to end each CP and C^2 training module. This AAR was conducted after the section AARs and was limited to 30 to 60 minutes. The exercise director conducted this AAR. As with other AARs, the focus of this AAR was improving staff performance. The staff left this AAR with a plan to improve its performance (sustain its strengths and improve where weaknesses were identified).

The commander was integral to the structured end-of-module AAR. The exercise director provided the commander a guide before each exercise to focus him on key activities. These guides also focused commander's comments during the AAR. The exercise director, assisted by the interactors, provided the commander an assessment of how well the staff kept higher and lower elements informed. After the exercise director reviewed the training objectives and tasks, the commander explained how the staff portrayed the tactical situation and how the staff helped/hindered his vision of the battlefield, situational assessment, and actions. The commander's comments complemented his after-exercise discussions with the XO/BC. The commander focused on improvements the staff made during the training. Prepared slides focused on activities that occurred during the module and assisted the commander in keeping his comments focused on staff performance.

The design called for the commander and staff to complete the end-of-module AAR by assessing their own performance. A slide (multimedia for some exercises) for each facet of performance was provided to assist the commander and staff in this assessment. After completing the assessment, the staff prepared an action plan to sustain and improve performance during follow-on modules or unit home-station training.

SOFTWARE DEVELOPMENT

The project team organized the software development process into phases or lots. Lot 1 allowed testing for the basics of battalion exercises. Lot 2 included modifications to support testing of brigade exercises. Lot 3 modifications enabled the development team to test the battalion and brigade TSPs using actual units.

Methodology

The software development planning built on the legacy code from the CVCC and SIMUTA C/ST projects. Therefore, only modifications and enhancements were considered. Initially, a list of desired software modifications (Table 8) was developed. The modifications were based on: (a) identified shortcomings in the legacy system which emerged during the SIMUTA C/ST formative evaluation and (b) the project team's experiences with the software. The basis for prioritization was contribution to the training objectives articulated in the program design. The software modification's final status is shown in the third column of Table 8 labeled "Delivered."

Of the items shown in Table 8, the three most critical changes needed to improve system capability were the abilities to: (1) use expanded radio nets, (2) change platform names from

battalion stations to brigade stations, and (3) display messages on the screen in a format consistent with tactical standing operating procedures (TSOP).

When the code was examined closely, a determination was made that it would not be cost effective to attempt only to enhance the legacy software. The legacy software had been designed to protect the integrity of the system. The players and radio nets were set by the programmer and could not be modified by the user. Although message contents could be altered using the text editor on the Sun workstations, the message formats were custom designed in C code. That meant that even a small change (e.g., have item X appear as line 2 instead of line 1) to a previously coded message or any new message would require expensive programmer code changes. The development team needed to be able to change messages and redefine nets and platforms as the exercises were developed. In order to change, the software approach was restructured to a data base methodology.

Formative Evaluation of the Software

As each software lot was delivered, the software was installed on a stand-alone Sun system. There, tests were run to see if expected performance standards were met. If no problems were encountered during this stand-alone trial, the software was loaded and tested on the network. When the pilots and the trials were conducted, the development team asked individual workstation operators to identify problems they encountered while using the equipment.

Table 8

Staff Group Trainer Project Software Modifications

Lot #	Description	Delivered Yes/No
1	Adjusted message formats so that more than 1024 bytes could be sent in a single message.	Yes
1	Reformatted staff journal to resemble the standard Army form.	Yes
1	Updated report formats and included Army standard message priorities.	Yes
1	Provide capability to adjust exercise execution speed. (Not delivered as desired but allowed the development team to change exercise speed.)	Yes/No
1	Developed capability for a workstation to annotate reports.	Yes
2	Modified station role assignments.	Yes
2	Reduced size of minefield symbol.	No
2	Modified radio net structures to handle various echelons and locations.	Yes
2	Increased color palette so that colors on the map display corresponded to military map colors.	Yes
3	Provided ability to pause and restart the exercise.	Yes
3	Provided ability to recover individual workstations.	No
3	Created capability to send overlays from workstations.	No
3	Replaced text-based exercise summary with graphic of message handling.	No
3	Provided menu driven controls to systems administrator.	No
3	Improved workstation recovery capability.	Yes
3	Provided capability to build database of each session that is keyed to staff position.	Yes
3	Developed automated Take Home Package (on a stand-alone personal computer platform).	Yes
NA	Added a 100 x 100 km map grid (not on the original list).	Yes
3	Simplified the required inputs for graphics.	No
3	Made "map edit" default mode to make use easier.	No
3	Made "highlight top" the default status of any overlay posted on top of the map display.	No
3	Added range fan symbols.	No

Key Software Enhancements

This section discusses the major software accomplishments achieved during this project. These mainly reflected the basic restructuring of the operational context of the software. These enhancements provided the most useful improvements to the system's training capabilities.

Changes to Message Formats and Editing Procedures.

The system was upgraded to a more flexible message input design. This was part of the development of new message formats. It provided the training developers with a message viewer similar to what might appear in custom data base forms. With this user-friendly Graphic User Interface (GUI) message editor, which consisted of text boxes and pop-up lists, the training developer could rapidly and accurately input pre-scripted messages needed to drive the structured training. This was a significant enhancement.

Impacts of Change

The impacts of the change were:

- Decreased operational costs if fielded. This modification decreased the man-hour requirements for exercise message construction by a factor of more than 40-to-1.
- Decreased errors in the message input to the point that messages could be created over a lunch hour and the exercise could be run when the staff returned.
- Eliminated likelihood of a system crash due to an improper message format.

Recommended Improvements

Capabilities of the message editor should be expanded to include generating the exercise message stream without having to enter the text editor on the Sun platform. This would further decrease man-hour requirements and potential for error, while maintaining flexibility.

Station Roles and Radio Nets

The delivered software no longer required new code and programmer assistance to modify station roles and radio nets. This enabled training developers to easily reconfigure the workstations to support various configurations necessary for the battalion and brigade TSPs.

Impacts of Change

The workstations could be reconfigured to accommodate multiple CP configurations. In the legacy system only one configuration was possible without a programmer changing the code. In the new system, the system manager could easily change the role of any workstation. This allowed the developers to modify the configuration for the various levels (brigade and battalion) and CPs (TAC, main, and rear CPs for the brigade, and main CP and CTCP for the battalion).

Recommended Improvements

It is still not possible to change the radio nets a workstation receives as the exercise is running. This means that a workstation can not switch from one radio net to another during an exercise. This capability should be examined if exercises are to contain training activities such as displacement of the main CP in which responsibility for the execution of battle must be transferred to the rear CP and sections must change the nets they monitor.

After Action Review Graphics

The design concept for AARs revolved around the actions taken by the staff with regard to "Key Teaching Point" messages and staff actions needed to provide commanders with orders and information to correctly implement the commander's intent. The SIMUTA C/ST AAR provided the training staff with feedback on what actions were considered to be doctrinally correct with respect to actions taken on incoming messages. All feedback was presented to the student in textual format. No use was made of the data collected in the instrumentation packages. In this project, an AAR plot was developed to graphically display the measurements collected. This plot showed various parameters on message actions (e.g., messages annotated, posting of messages to situation displays, etc.) across time.

Impacts of Change

The impacts of the change were:

- Graphic display of performance trends. This allowed the staff section to do performance self-assessment during the exercise.
- A more appropriate means of evaluating adult learning.
- Direct application of performance instrumentation in a form which was immediately usable by staff sections and developers/researchers.

Recommended Improvements

The AAR presentation capability should be modified to tie it directly to the training objectives--particularly monitor, process, analyze, and communicate. This would minimize an observer's subjective assessment and foster self evaluation. The AAR plot should contain links with message traffic processed on that station, so a message may be brought up and viewed while the plot is displayed. The plot could be expanded to incorporate performance during training "windows of opportunity" and include a solution overlay as part of the AAR.

EXERCISE DEVELOPMENT

The development team tailored the structured, simulation-based training methodology (Campbell et al. 1995). The methodology was used as a start, but it was found that the methodology did not fit a research and development project with undefined technology or a training device without documented task analysis and measures of performance. The

methodology was modified to that shown in the flowchart in Figure 9. One change was to split Phase 4 (Training Support Package Development) into Feedback Materials Development and Exercise Materials Development phases. In previous projects (SIMUTA, SIMUTA-B, and SIMBART), exercise material development was not required to the extent it was in the Staff Group Trainer Project. For these projects, the unit and interactors created the message traffic from what was unfolding during the simulation. For the Staff Group Trainer Project, the project development team had to create and then load into the computer system all messages that would be received by the unit staff.

Mission Development

Develop Tactical Scenario

The SIMBART brigade and higher orders and the SIMUTA-B battalion orders were used. Both of these projects had developed complete orders and graphics packages. The SIMUTA-B battalion was one of the battalions in the SIMBART brigade. These two sets of orders and an actual execution on Janus provided the training program tactical scenario and scenario events.

Determine Tactical Scenario Events

At the start of the project, the development team executed each SIMBART brigade mission on Janus and recorded the screen views on videotape. The exercise was recorded in two versions: one focusing on the battalion sector of the battle, the other showing activities in the brigade sector. These became the battles used for the Staff Group Trainer Project. The events to occur during tactical scenarios were determined by reviewing the events that occurred during these Janus executions.

Exercise Definition

Determine Exercise Training Objectives

During the project design phase, the team selected a logical progression in the training: staff sections, individual CPs, and multiple CPs. This progression was designed to prepare an inexperienced or poorly trained staff to conduct collective staff exercises in Janus or BBS. Within each training program table and module, there was a deliberate progression from exercise to exercise. Each exercise provided the staff an opportunity to practice and improve on skills from the previous exercise and added at least one additional training objective.

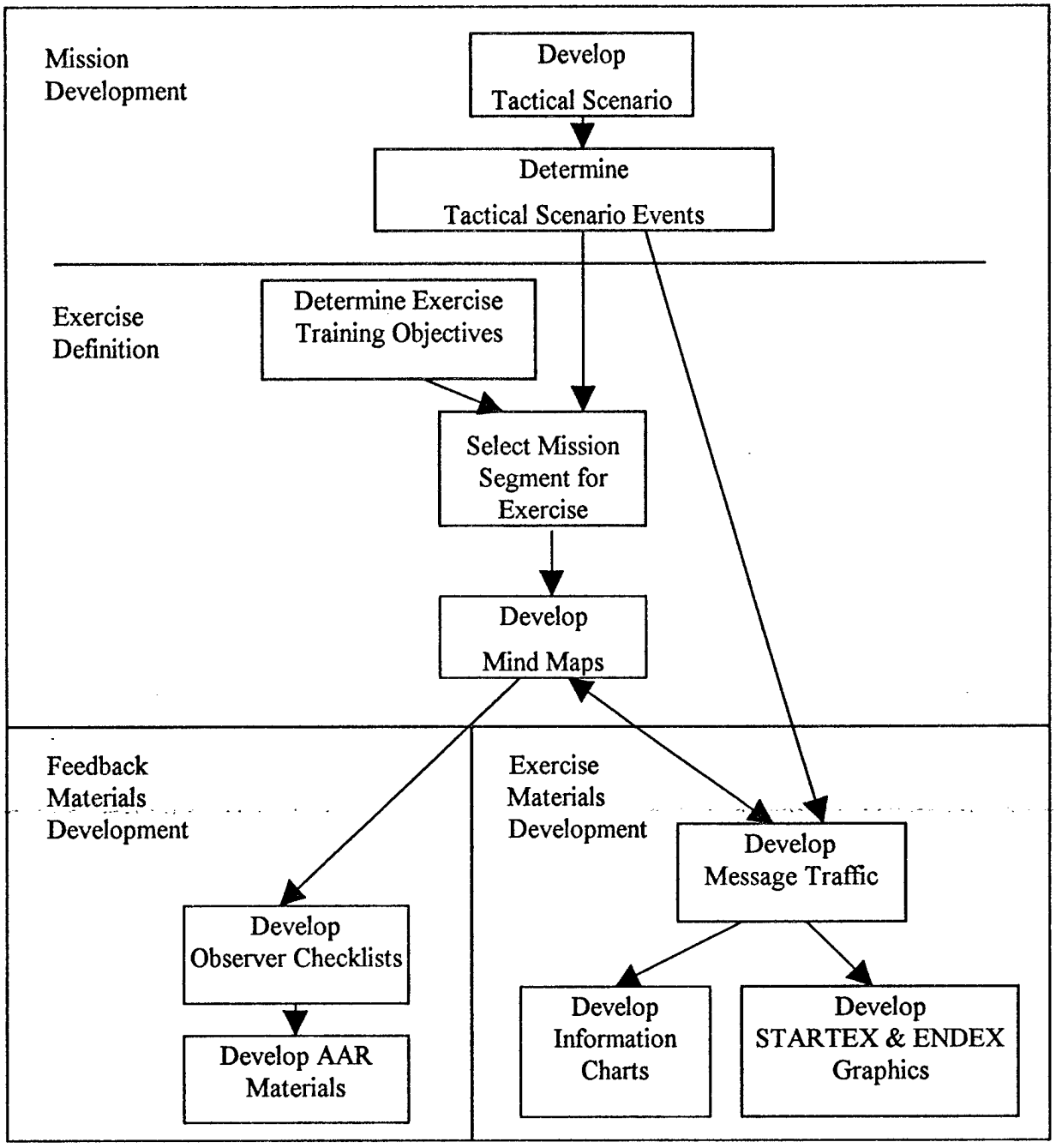

Figure 9. Exercise development flowchart.

Since the training objectives were centered on the staff support cycle (see Figure 5), early exercises started at the beginning of the cycle. Succeeding exercises continued along this cycle. The first three training objectives in the cycle--monitor, process, and analyze--did not depend on interaction with other staff sections. The staff section tables focused on developing the ability to perform these objectives within the staff section. This allowed staff sections to be trained independently but concurrently using the same message list.

Each CP module consisted of three exercises (see Figures 3 and 4). Because of equipment limitations, only one CP was trained at a time. The team designed the first CP exercise to train the first three training objectives, the same objectives trained in the last staff section exercise. The middle exercise focused on communicating analyzed information within the CP, and to the commander and higher and lower elements. The last exercise in each module was designed to end with the staff making a recommendation to the commander concerning a decision point.

The C^2 modules varied between the battalion and brigade TSPs. For the brigade, each module consisted of two exercises. The first exercise progressed to the recommendation at a decision point. The second exercise started with the commander making the decision and directing the staff to disseminate that decision. Finally, the staff was to aid the commander in synchronizing and directing the actions of the brigade units.

For the battalion, each C^2 module consisted of four exercises. The first two exercises progressed to a decision point. The last two exercises started with the commander having already made the decision and the staff going through the last three training objectives.

Select Mission Segment for Exercise

Exercise authors examined the tactical scenario and determined the specific time periods in the scenario when the training objectives could be met for each exercise. They kept the battle flow continuous for each module if possible. This meant that each exercise in a module would flow directly into the next exercise. This was accomplished for all but one module--battalion defense in sector. For this module, there was a 20-minute gap between two exercises coinciding with a break between echelons of the advancing enemy.

Since the development team designed the staff section tables to advance through only the first three training objectives, they restricted these exercises to periods in the tactical scenario without enemy contact--generally the early movement of the brigade or battalion in the movement to contact mission. They kept the first exercise relatively short and simple so the staff could master the initial objectives and get accustomed to the training system. The second exercise began from the end of the first exercise and continued to just before initial contact with the enemy.

For the brigade CP and C^2 modules, the exercise authors selected a decision point for each module and went backward or forward in time from that decision point to meet the designated training objectives. For battalion C^2 modules, the exercise authors used doctrinal phases as described in FM 71-2 (Department of the Army, 1988d) to determine the content of the exercises.

Once each exercise author defined the time period and key events within that time period, he completed the exercise outlines.

Staff Support Process Model

The staff support process model was a pictorial showing an exercise key event and associated message traffic plus the minimum expected staff behaviors (a sample is at Figure 10). The pictorials became training aids to help the staff understand how key messages prompt staff actions and how sections combine pieces of information. It also helped observers facilitate discussion with staff section members on key events and actions.

Exercise Materials Development

Once the exercise outlines were finished, authors developed exercise materials. The following sections describe the methods and resulting products.

Develop Message Traffic

The team conducted a map exercise, augmented by the Janus videotape, DST and synchronization matrix, to determine the type of message traffic that should be received by the training staff from subordinate, adjacent, and higher units or staffs for each scenario. They put this information into a message summary database. This database included time, report type, whether the message was a key message, originator, addressee, radio net, message summary, and a training outcome for each message. After the map exercise, the team developed message summaries for each mission. Based on the message summary database, the team constructed the message traffic database. Using Janus videotapes as a reference, the development team verified activities, times, locations, and strengths of both enemy and friendly units against the estimates made by exercise authors.

Develop Information Charts

To begin this development, the team initially used the set of charts in Field Circular (FC) 71-6 (Department of the Army, 1985) as a baseline to determine what information charts each staff section would maintain. Examples of these charts are: enemy strength and location, friendly strength and location, and completion of elements of the reconnaissance plan. Once the message traffic for each exercise was developed, exercise authors prepared information charts for each staff section. Authors prepared these charts for the beginning and end of each exercise. They obtained the beginning information by reviewing the Janus videotape and the message database up to the start of the exercise. The ENDEX charts were prepared by adjusting the charts based on message traffic during the exercise. The development team found that information needed to keep the charts accurate was not always in the message database. Each exercise author went back to the Janus videotapes to verify the required information. This led to more messages being added to the tactical scenario and exercise message databases.

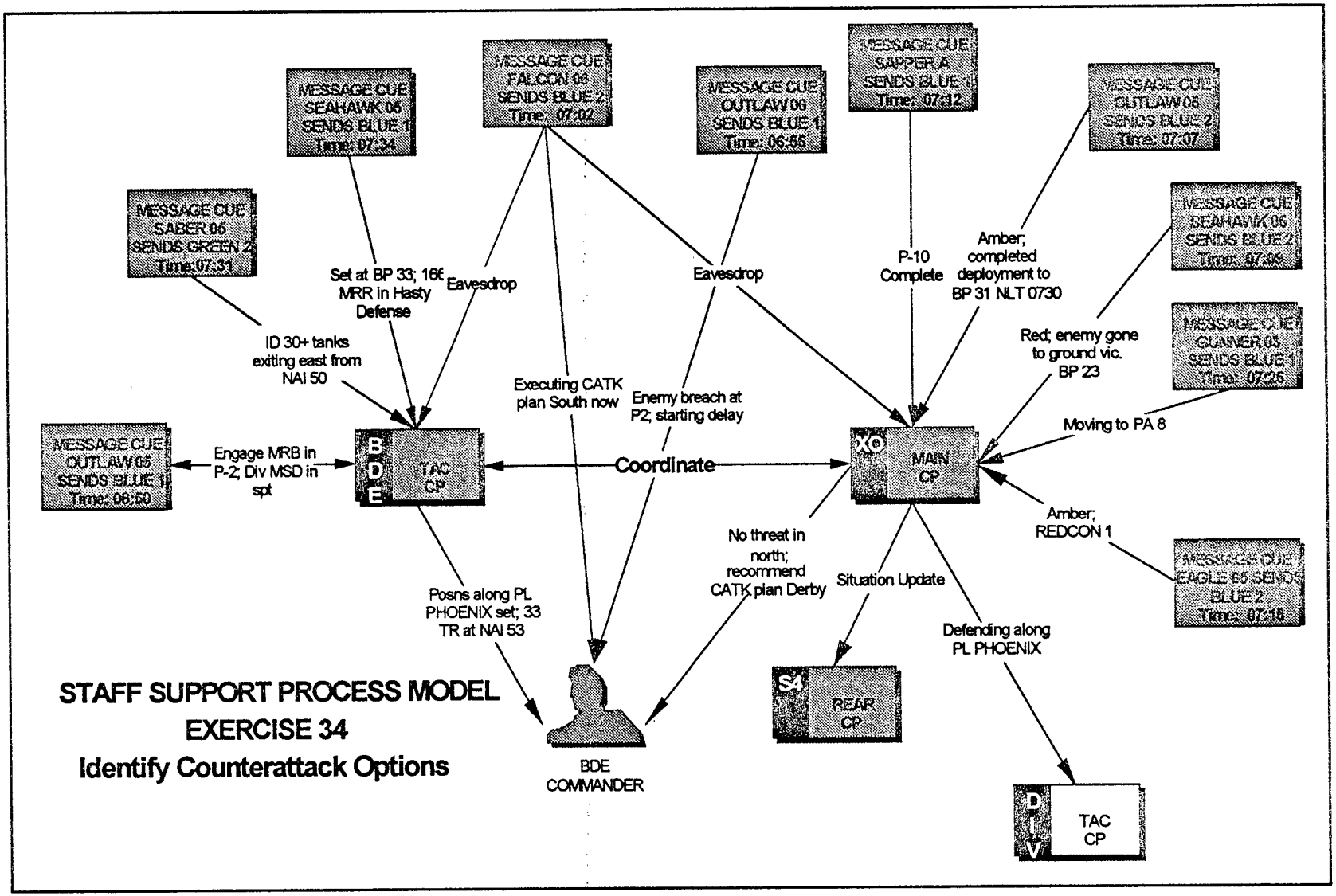

Figure 10. Staff support process model - Brigade Exercise 34.

Develop Exercise Graphics

The same procedure used to develop information charts was used to develop exercise graphics. The exercise authors determined the location of all friendly and enemy units at the start of each exercise and created the overlay for the workstation map display. Then, based on message traffic and the Janus exercise, the location of all units at the end of the exercise was determined. Often the message traffic did not support the ending location of friendly and enemy units. Additional messages to support the end-of-exercise graphics were created as needed.

Development of Feedback Materials

Feedback materials focused on key events in each exercise. Each exercise was designed to have only two or three key events. This allowed the observers to concentrate on observing and providing feedback on those key events.

Observer Checklists

The observer checklists were designed to be easy to use, focus only on key events, and allow the observer to concentrate on staff performance. For every exercise, authors developed a checklist for each observer and the exercise director. Each section observer checklist contained key messages for the section, expected section activities, coaching cues, and a place for observer comments (Figure 11). The exercise director's checklist (Figure 12) focused on the information needs of the commander. This was linked to the commander's C^2 cycle (see, assess, decide, act) (Department of the Army, 1995).

After Action Review Materials

The section observer's AAR material consisted of: end-of-exercise action plan worksheets, observer checklists, a staff support process model, and ENDEX charts and overlays. All of this material was discussed in previous sections.

The training objectives were synchronized with evaluation and feedback material during a map exercise. During this exercise, team members assessed if message traffic, DST, synchronization matrix, staff support process models, and observer checklists were in agreement. As a result, some message traffic and checklists were revised.

Instructions When the message listed below is received by your staff section, the staff section will likely complete the action in the first column. Place a √ if the expected action was taken without prompting and an O if it was not. If the staff action was not completed, use the coaching question to help prompt the staff section to consider whether or not they should take an action. All "O" marks require that you describe the actions your staff section *did* take in processing and communicating the information.

Event	Message	Time Sent	Originator
Enemy breaching obstacle belt P2; delaying to BP 31	Blue 1	06:55:00	Outlaw 06
33d TR exiting NAI 50 moving east	Green 2	07:31:00	Saber 05
TF SEAHAWK set at BP 33; no contact	Blue 1	07:34:00	Seahawk 05

Expected Staff Action	√ or O	Training Objective	MTP Task #	MTP Task	Coaching Question	Comments
Integrate enemy time/ distance to repositioning of OUTLAW		Integrate/ Recommend/ Disseminate	71-3-2006-e	Disseminates intelligence to all subordinate elements in the brigade and staff	Will OUTLAW be in position to defend by the time enemy breaches P2?	
Integrate enemy movement with overall Bde plan		Integrate	71-3-2003/2	Once information is deemed pertinent, analyzes incoming intelligence and combat information to determine impact on friendly operations	What does the TR movement signify?	
Recommend CATK course of action based on enemy behavior		Integrate/ Recommend	71-3-2006/1	Processes intelligence and combat information	What does lack of contact in SEAHAWK sector indicate?	

Figure 11. Intelligence section observer's checklist - Brigade Exercise 34.

Instructions Use this checklist to collect the unit commander's observations on Exercise 34.

"K" Event #	"K" Event Description
1	269 MRR breaches Obst belt P-2
2	TF SEAHAWK closes into BP 33
3	TF OUTLAW delays to BP 31
4	33 TR exits NAI 50

Cdr's Command & Control Cycle	Staff Support Functions	Event	DST Criteria	Comments
See	Monitor, Process, Analyze, Communicate	TF OUTLAW at BP 31	Enemy stalls at P4 obstacle belt	
Assess	Integrate, Recommend	TF EAGLE attacks into OBJ CHURCHILL	Enemy stalls at P4 obstacle belt	

Figure 12. Exercise director's checklist - Brigade Exercise 34.

TRAINING SUPPORT PACKAGE DEVELOPMENT

The TSPs consisted of paper-based instructions and other non-traditional components (the computer program on the training system, message databases, preview and AAR materials on computer system). This section focuses on the paper-based instructions.

Development of battalion and brigade TSPs evolved from lessons learned in previous projects--SIMUTA and SIMBART. The original Staff Group Trainer Project's TSP design was based on the SIMBART TSP. However, the mission volumes were modified because of the difference in the program structure. The following organization was used:

- *Volume I: Training Guide,*
- *Volume II: Unit Preparation Materials,*
- *Volume III: Staff Section Table,*
- *Volume IV: CP Table,* and
- *Volume V: C^2 Table.*

Several packages supplemented these volumes. These materials included:

- *Tactical Materials:* This volume contained all orders and the TSOP used in the program. The brigade *Tactical Materials* contained the division and brigade orders and the brigade TSOP. The battalion *Tactical Materials* contained the brigade and battalion orders and the battalion TSOP.
- *Workstation Operator's Guide*: This guide was the same for both TSPs.
- *System Administrator's Guide*: This guide was the same for both TSPs.
- *Train-the-Trainer Guide*: This guide instructed a training team how to administer and conduct the battalion and brigade training programs. Because of differences between the two programs, the *Train-the-Trainer Guide* supplement differed between the two TSPs.
- *Program Highlights*: Because of the differences between the battalion and brigade programs, a separate program summary was prepared for each.

The following sections highlight the TSP development process.

Structured Writing

The structured writing methodology was used in preparing the TSPs. Structured writing emphasizes (a) separating information into small units by purpose and function so it can be easily read and understood, (b) sequencing information based on its use and need, (c) labeling topics for

easy scanning, and (d) presenting information in modular units so it can be easily modified (Horn, 1995). Users of the SIMUTA-B and SIMBART products reported that the structured writing presentation made the packages easier to use than the more traditional, prose-style approach (Graves & Myers, 1997; Koger et al. 1996).

Battalion Prototype Exercise Development and Delivery

The exercise outlines were used to develop a battalion prototype TSP. The battalion prototype package contained support material for 4 of the 32 exercises in the battalion training program. The prototype package included the movement to contact module from the C^2 table. These exercises allowed a comparison of the new exercises to the SIMUTA C/ST exercises. The prototype provided sample materials for external review. Comments from the prototype reviews are discussed in the formative evaluation section.

Brigade Prototype Exercise Development and Delivery

The brigade prototype package included exercises 14 through 16 (the main CP module of the CP table). The prototype contained all the exercise support materials for these three exercises. Comments from the prototype reviews are discussed in the formative evaluation section.

Battalion Draft Training Support Package Development

The draft TSP was used and reviewed during the pilot and implementation trial and then refined based on user and customer comments.

The battalion draft TSP contained *Volumes I-V* and the *Tactical Materials*. Some of the CTCP exercise materials in *Volume IV* and all of *Volume V* were still being developed. The *Workstation Operator's Guide*, *System Administrator's Guide*, and *Train-the-Trainer Guide* were also delivered in the draft TSP, although some of their components were still being developed.

A new document, *Staff Group Trainer Program Highlights*, was added to the package. The *Highlights* summarized the battalion training program. It became "tool" the VTP Observer/Controller (O/C) team had requested during the prototype review.

Brigade Draft Training Support Package Development

The brigade draft TSP was structured similarly to the battalion draft. However, the development team did not prepare a brigade *Workstation Operator's Guide* and *System Administrator's Guide* because the functions were the same regardless of echelon. As with the battalion draft TSP, the development team prepared a *Highlights* document that summarized the brigade training.

Final Training Support Package Delivery

The final versions of the battalion and brigade TSPs were delivered after the revisions resulting from the implementation trials were completed. Final development included adjusting messages and overlays to better support the exercises, finalizing TSP contents, and finalizing the Staff Group Trainer Project electronic files.

FORMATIVE EVALUATION

Two levels of formative evaluation were conducted throughout the project--internal and external. The external evaluations consisted of prototype exercise reviews, pilots, and implementation trials. Previous sections described the internal reviews. The following sections describe the results of the battalion and brigade prototype exercise reviews, pilot tests and implementation trials.

During the external evaluations, team members collected feedback using a variety of methods. For the pilots and implementation trials, team members observed specific aspects of the training implementation techniques and exercise design. Immediately after each pilot and trial, they compiled their observations. During the pilots, the team questioned the participants after each exercise. At the conclusion of each pilot, they interviewed all participants as a group. During the trials, all training team members completed questionnaires and participated in "hot washes" at specific points in the training. Participants completed questionnaires at the conclusion of each module and participated in a group interview after the trial. Post-trial group interviews with the training team during the week following each trial were conducted. The comments in this section were obtained from combining the information gathered from all these methods.

Prototype Reviews

Participants in the battalion prototype review were representatives of the battalion VTP O/C team. Participants in the brigade prototype review were representatives from the Combined Arms and Logistics Centers, Intelligence School, and the brigade and battalion VTP O/C teams. The comments on the exercises were compiled by members of the development team. The following discussion lists significant points made during the prototype review concerning exercise development.

The purpose of the prototype reviews was to have potential users review the training program and materials. The reviews focused on what the development team could do to make the training programs more effective and the TSPs more useful. Selected reviewer comments are discussed in the following paragraphs.

The reviewers were concerned about the highly structured AARs. The development team maintained that more structured and prescriptive AAR instructions and materials enabled a less experienced observer to provide valuable feedback to the staff section he was observing. Final testing during the trials and subsequent field interviews with commanders for the follow-on Staff Group Trainer Project confirmed the need for the more structured AAR method.

Reviewers questioned whether internal CP communication and coordination would be conducted face-to-face or through the workstations. The team modified instructions and expanded the train-the-trainer program and staff orientation to ensure the staff sections understood that internal CP communication and coordination should be conducted face-to-face.

Reviewers were concerned about exercise speed and the use of pauses. Allowing the exercise to be slowed to less-than-real-time execution, or paused, were features not available in real-life situations. The reviewers questioned whether the pause feature would ease the stress of battle and dilute the training value of the exercise. However, the "crawl" nature of the Staff Group Trainer Project's methodology argued that slowing exercise speed or pausing the exercise allowed staff sections more time to learn the basics of staff coordination and synergy before progressing to a real-time, more realistic exercise, such as Janus or BBS missions.

In the training program design at the time of the battalion review, a battalion staff progressed through the training program using the movement to contact scenario for the staff section table, the main CP used the deliberate attack for its CP module, the CTCP used the defense in sector scenario for its CP module, and the battalion staff chose any of the three scenarios for the C^2 table. The reviewers believed it was difficult for a unit to study and be prepared to execute all three missions. The team changed the CP table so that each CP would use the deliberate attack scenario for its CP modules.

Workstation availability was addressed during the reviews. At the time of the reviews, there were only six workstations available. As a result, some staff sections shared workstations during the C^2 exercise. This was seen as potentially a serious training problem. More workstations were obtained before the end of the project.

The reviewers suggested improvements in the message traffic. These suggestions were incorporated into subsequent TSPs. The reviewers recommended that some information on the message list be eliminated. The message list included items that cued staff actions, actions that staff members were expected to perform when they received messages, and the BF tasks on which their actions were based. All this information, though useful, made the message list lengthy and difficult to use. The list was modified to include only basic message information--time, whether or not the message was a key message, report type, originator, addressee, net on which the message was sent, and message summary. The other elements (expected staff actions and BF references) became part of the observer checklists and staff support process models.

The reviewers indicated there were redundant instructions in the TSP chapters for different training team members. They suggested eliminating that redundancy by moving instructions and materials pertinent to all trainer positions into a single section at the beginning. The development team used these suggestions in developing the brigade prototype exercise packages.

Reviewer comments on the brigade prototype led to major revision of the Training Guide (Volume I) and Unit Preparation Materials (Volume II) for the draft TSPs. Additionally, the reviewers suggested that both volumes could be presented in a multimedia format (e.g., videotape, CD ROM). They felt the user would prefer the multimedia format over reading the

material. Reviewers were enthusiastic about observer checklists and staff support process models. They stated both should be helpful in providing performance feedback to training staffs. They also discussed the need for a tool to capture the staff section and CP's action plans so that the results could be easily incorporated into the final THP.

Pilot Tests

The development team scheduled each pilot test--battalion and brigade--for a three-week period. A training team was required for the entire three weeks, while the staff was required for only the second of the three weeks. When the software and exercises were not ready for the battalion pilot, the team restructured the pilots. This restructuring still allowed the team to test the exercises prior to the implementation trials. Each pilot was reduced to a single week. Because of scheduling constraints with the VTP O/C team, the brigade pilot was conducted one week followed by the battalion pilot the next week.

The purpose of the pilots evolved into preparation for the implementation trials. The development team crafted the following objectives for the restructured pilot tests:

- Train the VTP O/C team to operate the training system,
- Familiarize the VTP O/C team with the training programs, and
- Evaluate all exercises and materials scheduled for the trial.

For the brigade pilot, the VTP O/C team served in a variety of roles to experience the training from different perspectives. To start, the development team delivered the workstation operator training to the VTP O/C team. Following this, the development team gave the VTP O/C team a short orders briefing on each mission, then asked them to review the orders package. The O/C team performed as workstation operators during the section table, while the development team performed as staff officers. For the CP table, the development team performed as workstation operators while the O/C team performed as staff officers. Finally, for the C^2 table exercises, the O/C team acted as observers and the development team role-played as the unit staff--both workstation operators and staff officers. This allowed the O/C team members to gain experience in all the roles required for the training, and participate in all the exercises scheduled for the trials.

Because of lessons learned during the brigade pilot, the development team made some changes to the battalion pilot. The brigade O/C team had not achieved a full conceptual grasp of the training until the last day, when the development team functioned as the entire staff and the O/C team functioned as observers. The development team conducted a demonstration at the beginning of the battalion pilot for the O/C team participants. The demonstration appeared to help the participants grasp the concept. This demonstration was added to the train-the-trainer program and to the unit orientation.

Brigade Pilot Results

The brigade pilot was the first opportunity to test the train-the-trainer materials. Though limited in scope, the executed portion included providing an introduction to the training program, workstation operator and system administrator training, and a review of tactical materials. The workstation operator training was well received, with the following suggestions: (a) add practice exercises to link the individual workstation operator tasks with the workstation operator practical exercise, (b) include staff section officers in some parts of the workstation operator training so they have prior knowledge of workstation capabilities and limitations before executing the staff section table, and (c) emphasize creation of new reports with consolidated information rather than routine forwarding of received reports.

The VTP O/C team requested more combat service support traffic and overlays, engineer traffic, and intelligence traffic. Inconsistencies between the message traffic and overlays were identified and marked for correction. The O/C team indicated that the exercises might have too much happening in too little time and thus be unrealistic. However, the development team explained that the times were based on the same missions executed on Janus.

During the pilot, the training system only had a 50K x 50K map grid that could be used by the brigade staff. The brigade Janus exercises used a 100K x 100K terrain database for the simulation. This terrain database extended approximately 50K further west and south than the 50K x 50K battalion terrain database. In the brigade Janus exercises, the staffs used paper maps for their work and had no interaction with the simulation's terrain database. Some of the brigade area defense- and movement to contact-based exercises were conducted off Staff Group Trainer's 50K x 50K map grid. To compound this, the intelligence message traffic for the brigade Janus exercises extended beyond the simulation's brigade 100K x 100K terrain database. Since the brigade staffs in the Janus exercises used paper maps this did not present a problem for them. In the Staff Group Trainer exercises, the staff used the system's map to track all friendly and enemy units. As a result, approximately 60% of the enemy graphics and some friendly units were off the system's map. This made it difficult for the brigade staff to execute the exercises.

Revisions were made to the exercises and TSPs to respond to these comments. The 100K x 100K map capability was delivered prior to the brigade implementation trial. The larger map was not required for the battalion exercises.

Battalion Pilot Results

The following key issues resulted from the battalion pilot:

- The system administrator needed to be proficient to execute exercises.
- The demonstration helped the participants to grasp the training concept.
- The staff section table needed to be more challenging.
- The message traffic and overlays had to be checked for accuracy and consistency with OPORDs.

Where possible, modifications were made to the TSPs and exercises to address these issues.

Battalion Implementation Trial

The Staff Group Trainer Project's hardware suite was moved to the Mounted Warfare Test Bed, a new software drop was put on the system, and two workstations were added to the system between the pilots and the battalion trial. The train-the-trainer phase (including workstation operator training) was conducted for the VTP O/C team during the first week of the trial. The O/C team conducted the training for a surrogate battalion staff during the second week of the trial. During the trial, the staff executed all staff section table exercises, the main CP module, and the C^2 table movement to contact module.

There were software/hardware problems resulting from moving the system, adding two workstations, and installing a new software change. The development team was not able to resolve these problems until the last day of the trial. Because of these problems, the training schedule was adjusted. The schedule changes and delays caused by the system problems contributed to negative comments from some staff members. In their after-trial responses, staff members reported that the training system's hardware/software interfered with training, the training program was not responsive to staff actions, the training program was too complex and too long, and the message traffic did not contain enough messages and contained too many mistakes. The battalion O/C team echoed many of these comments. Development team members observed many of the same problems and sought solutions.

The development team realized a number of positive results from the trial. Based on observations and feedback from the participants, the following findings emerged:

- Individual section performance and main CP interactions improved.
- The staff progressed through the staff support cycle.
- The observer checklists were relatively easy to use and helped the observers keep section AARs focused on training objectives.
- The staff support process model proved to be a useful tool.
- The discussions between the XO/BC, commander, exercise director, and CP observer were important in training the XO/BC.
- The importance of several key players--commander, exercise director, and interactors--was highlighted. The commander must be involved in the training. He must set the tone and inform the staff of his information needs. The exercise director must assist the commander throughout the training. The interactor cell must be staffed by at least two people in the CP and C^2 modules. These two individuals must be knowledgeable about staff activities and familiar with the exercises.

- The end-of-module AAR needed to be more structured with additional training aids to assist the exercise director and commander.

Brigade Implementation Trial

The development team implemented some of the lessons learned during the battalion trial in time for the brigade trial. Added emphasis during the train-the-trainer program was placed on areas where the training program was not implemented as designed during the battalion trial. This emphasis proved beneficial as training team members followed the instructions presented in the training. The team created a multimedia end-of-module AAR presentation to help the commander and exercise director focus on the training objectives. A fire support expert was also added to review all the exercises, add fire support traffic, and correct faulty message traffic and overlays. The workbooks and training team materials were also streamlined.

The VTP O/C team served as the training team for the brigade implementation trial. They went through the train-the-trainer phase (including workstation operator training) during the first week of the trial. The O/C team then conducted the brigade training program the following week. The brigade staff was an ad hoc staff assembled from units at Fort Knox, Kentucky and elsewhere.

At the conclusion of the train-the-trainer phase, which lasted less than three days, the development team obtained the VTP O/C team members' opinions about the program and materials. The O/C team indicated that more time was required for them to prepare to conduct the training. Their estimate was a minimum of five days with additional time required for the interactors. They stated that the training program was overly complex.

Members of the ad hoc staff and O/C team were concerned that the workstation operator training program was not ensuring the operators would be proficient for exercise execution. The development team observed that a few workstation operators fell behind in processing messages during the exercises. The team noted that there were too many messages being forwarded on the same net (repeating the same message on the same net), use of the system to do internal CP coordination when face-to-face communication was expected, and forwarding of individual messages rather than creating new, consolidated messages or providing the analysis of a group of messages. These practices all increased the workload for each workstation operator and were contrary to workstation operator training. Members of both the ad hoc staff and O/C team recommended that training audience members be briefed on the workstation capabilities.

For the brigade trial, the software/hardware problems that had been encountered during the battalion trial were remedied. There were no software/hardware problems to interfere with training. In their after-trial responses, the brigade staff members and O/C team members reported that the training system (hardware/software) got in the way of training, the training program was not responsive to staff actions, the training package was too complex, and the message traffic was not adequate and contained mistakes. The brigade staff members and the O/C team members reported the training system got in the way of training because the system was new and the CP environment was different because all means of external communication were replaced with the

system. The staff members wanted the CP environment to mirror the field CP to include configuration and equipment.

The project development team observed many positive aspects of the program. Despite comments by the participants, staff performance did improve. The developers noted that the staff did improve in monitoring unit activities and asking for more information from the units concerning their activities. Information was processed more rapidly and efficiently, and more analysis of the information was accomplished. During early exercises, more messages were forwarded without analysis to sections that had already received them.

LESSONS LEARNED

This section reports the major lessons learned by the development team during this project. The intended audience consists of: (a) training developers, (b) program sponsors who allocate funding or training programs and establish program goals and objectives, and (c) training implementers. These lessons describe problem areas encountered, suggestions on how to avoid or cope with these problems and areas the development team felt were informative.

This section is organized based on the phases--analysis, design, development, implementation, and evaluation--in the Army's Systems Approach to Training (Department of the Army, 1988e).

Analysis

There were four major lessons learned during the analysis phase of this project. These lessons learned dealt with training audience characteristics, training program goals, training resources, and training objectives. This section discusses each of those lessons.

Training Audience Characteristics

During the pilots and implementation trials, branch school representatives and VTP O/C team members challenged the training design audience characteristics. The development team used the training audience characteristics identified in the statement of work (SOW) at the beginning of this project. As a result of these challenges, the development team interviewed several brigade commanders. These interviews validated the training audience characteristics used in the project. The lesson learned is that future projects should include an analysis of training audience characteristics and needs at the beginning of the project.

Training Program Goals

The team established goals early in the program to guide the design, development, implementation and evaluation of the training. Using these goals, the development team created a training program to bridge a training gap between individual skills and collective staff skills; however, they discovered the training gap to be greater than originally thought. The resulting discussion between the sponsor and the development team produced a shared understanding of the training gap and a refinement of the training goals--an understanding that, unfortunately, was not shared by all trainers and participants. Consequently, the development team learned the importance of selecting trainers and participants for the formative evaluation phase who understand, or "buy into," the goals and purpose of the program. This convergence of understanding is particularly important when pilot and trial trainers and participants are not part of the intended audience, e.g., an actual unit staff, but are emulating that audience in the evaluation exercises.

Training Resources

During pilots and trials the development team uncovered insights about module duration and the training team. Interviews with the brigade commanders, verified these insights. If these areas had been uncovered in the analysis phase of this project they would have resulted in major modifications to the project design.

Module Duration

Comments received during pilots and trials questioned the length of the program and modules. In interviews with brigade commanders, commanders indicated that they could accommodate a four-hour block of training for their staff as often as once a week or as infrequently as once a quarter. Commanders suggested that blocks of training be designed not to exceed four hours. No time restrictions were considered in the analysis and design phases of the project. The development team focused on meeting the training objectives. As a result, modules consisted of two to four exercises based on the development team's estimates of what was required to achieve the training objectives (see Table 9).

Table 9

Module Duration

	Number of Exercises	Expected Length per Module (Hours)
Battalion Training Support Package		
Section module	2	4
CP module	3	8
C^2 module	4	12
Brigade Training Support Package		
Section module	2	4
CP module	3	6
C^2 module	2	6

As a result of the pilots and trials, the development team determined that adjustments could be made to reduce each module to four hours or less. In most cases this could be accomplished by reducing the number of exercises in a module. Each module would typically consist of two exercises. The second exercise would reinforce what the training audience learned during the first exercise and its AAR. These adjustments were not made in this project's training program but were suggested for follow-on work.

The lesson learned was that the duration of training must fit into the target audiences' anticipated time allocation for the training. Developers can never ignore or discount available training time. During the analysis phase of training program development, the training developer, sponsor, and potential user must determine anticipated training time restrictions.

Training Team

The training team is a training resource that influences the design of a training program. In interviews with brigade commanders, the commanders indicated that resources for a training team are very limited and that any training team for staff training would probably come predominantly from inside the unit headquarters (battalion or brigade). Training teams such as the VTP O/C team are typically not available for a local commander's staff training program and funding for travel to a staff training site is generally not available. Thus, structured, computer-driven staff training should be available at the brigade's home station and require a minimal training team.

Reducing the personnel overhead requirements for staff training represents a significant cost saving to the military. In this project, only support personnel--system administrator and interactors--did not actively observe and provide feedback to the training staff. This contrasts with a Janus exercise where support personnel can easily consist of 20 to 30 people in addition to the observer team. However, even the requirements for 9 to 12 observers plus the support staff would still exceed the personnel immediately available to the brigade commander. Future efforts must strive to reduce the training team to numbers the brigade commander can support. The training benefits or losses associated with various training team structures should be explored.

Training Objectives

Integration of the Staff Support Cycle into the Training Program

In the SIMBART program (Koger et al. 1996), the SIMBART Team had difficulty in getting the O/C team to focus the AARs on staff processes. The SIMBART Team had not integrated the SIMBART staff support cycle (see Figure 5 earlier in this document) into the training objectives and observer checklists. As a result, the O/Cs were able to circumvent the staff cycle. During the AAR process they did not focus on the brigade staff's actions. In the Staff Group Trainer Project, the development team further evolved and integrated the staff support cycle into the instruction design. They adjusted the SIMBART concept and developed the staff support cycle to include BF analyses tying training objectives with specific tasks and performance. The cycle defined the training objectives for the training programs. These objectives in turn were used to structure the observer checklists and AARs. Because of this integration, the training team accepted the staff support cycle and used it in conducting all AARs. The lesson learned is that by tightly structuring the training objectives into the trainer support materials, resistance to implementation as designed is decreased.

Measuring Performance of Training Objectives

In this project, the development team did not quantitatively analyze the training objectives. They did refine the training objectives and tie them more closely to staff tasks and BFs.

The first several of these training objectives--monitor, process, analyze and communicate--can be measured by instrumentation on the computer system. However, if the Staff Group Trainer's computer-driven, structured training environment is fielded, it must not just claim to train performance, it must have developed and evaluated measures of performance for all tasks to ensure that commanders can determine that training does take place.

Design

It is difficult to design exercises that train processes, and provide a high likelihood of success, while providing a challenging training progression. This section discusses major lessons learned in the development team's attempts to design a program that would meet this goal. Additionally, this section discusses the team's use of a shared mental model to enhance team training.

Separating Process from Outcomes

The AARs in previous SIMUTA and SIMBART staff training exercises were long and focused on battle outcomes rather than staff processes (R. G. Hoffman et al. 1995; Koger et al. 1996; Graves & Myers, 1997). This is typical of AARs for most battle exercises and simulations where winning is the objective not how you play the game. The Staff Group Trainer is not a tactical trainer. The exercise is information-based. Battle scenarios serve only as the means to drive staff actions. They are designed to elicit individual and team behaviors. To train the staff it is necessary to focus on staff processes. The information provided to the staff is selected to paint a picture which will cue specific staff behaviors. This information is highly structured. Observers know when staff behaviors should occur and they can focus on the staff's reactions to these cues.

The development team intentionally designed the exercises to be short to separate staff processes and actions from battle outcomes. The staff acts and produces specific staff products. But, the exercise is stopped before the staff's recommendations or products have an opportunity to influence the battle outcome. While some participants were disappointed because their actions and products had no impact on the battle, the structure helped the training team remain focused on process during the AARs because there were no outcomes to discuss. The development team learned that short, structured exercises improved the acceptance of the training focus on staff processes.

Training Progression

Staff Group Trainer training began with a section table, proceeded to the CP table and then the C^2 table. The team believed that this organization would provide a logical progression for staff development. As discussed previously, they designed the exercises in the tables to provide a high likelihood of success for the participants. Thus, early exercises and tables would

be easier than later exercises and tables. During the trials, the development team observed a significant gap between performance requirements for staff section table modules and the CP modules.

From their observations during the trials, the team determined that staff section exercises had not prepared the sections to continue to the CP table. This meant that either the objectives of the staff section table were not achieved or that there was not a smooth progression between the last staff section exercise and the first CP exercise. Feedback from users and the development team indicated that the staff section table exercises needed to be more challenging. These exercises as implemented were too easy even for a staff section at the crawl level of training. From the trials, the development team determined that they had not provided a smooth progression from the section table to the CP table. The team looked at making the staff section exercises more challenging

Since this training focused on a staff in its early stages of training, process-related goals were appropriate especially in the early exercises. Upon review, the development team conceded that the training program did not adequately assist the staff section in achieving the table training objectives. The exercises were too easy and failed to focus the observers adequately on the processes needed for a staff section to meet the commander's informational needs. Correctly designed these exercises should focus the staff section on what it must look for, where to find it, and what to do with it once found.

Whether or not the training program requires a C^2 table deserves further investigation. While the Staff Group Trainer program has C^2 tables, the developmental complexities–increased number of workstations, increased number observers, increased workload on the interactor cell, ability of the system to handle communication between CPs–associated with design of such tables proved to be extensive. Because of these complexities and additional resources required, the usefulness of the C^2 exercises on the Staff Group Trainer system was questioned. Further research is required to determine if the training without the C^2 exercises would be sufficient to prepare the staff for Janus or BBS exercises.

The lesson learned in developing progressive tables is that the development team must look carefully at the objectives at each level. Because of the progressive nature of the structured training program, the staff must be successful at the section level before continuing to the next level. The training audience must achieve the training objectives at each level if they are to be successful in later stages of the training. A possible solution would be to make the staff section modules more challenging and have the section focus on staff processes; however, this would only partly smooth the progression between the section table and the CP table. The development team thought the staff also might require an additional level of exercise before the CP exercises. This level would be composed of specific staff group modules. These modules would focus on selected parts of a staff that must work together in specific instances (e.g., targeting cell composed of fire support and intelligence section personnel). Training a specific staff grouping would better prepare them to work together within the CP environment of subsequent modules.

Staff Success in a Challenging Environment

The training matrix conceptualized at the beginning of this project (Figure 6) provided for multiple entry points and different paths through the program based upon proficiency. These entry points and proficiency-based paths would help to provide the flexibility necessary for "flow." These were not developed. While additional entry points and paths must be developed for robustness these may create conditions that may disrupt the performance cues designed in the base exercise. It will be necessary to test thoroughly the exercises to prevent introducing confounding factors.

The automated assessment software should be designed to recognize less than optimum performance and suggest alternative methods to provide coaching modes depending on the performance level and desires of participants. For example, some participants may want coaching suggestions automatically provided, others may want suggestions only when they request them, and others may want no coaching or suggestions at all.

Shared Mental Models

As explained earlier, this shared mental model concept has the team sharing a common vision of the game and each person's role in that game. Klein and Thordsen (1989) described this as a "team mind." Coaches have explained this as teammates having played together enough so that they anticipate each other's moves. The development team saw the application of this concept as a staff support process model (see Figure 10) which graphically depicted the staff actions surrounding each exercise's key events.

The training design reinforced this concept. It provided time for the commander to share his model (vision) of the upcoming exercise and his expectations for the staff before each exercise. The commander used the DST to focus the staff on what he anticipated would be the staff's actions/interactions during the exercise. At the beginning of the module AAR, the commander repeated his expectations and provided the staff information on what he received. Finally, the staff and commander determined the actions they needed to improve during the next exercise to ensure the commander had the information needed to conduct the battle.

The team saw great potential in the strategies they used to integrate the shared mental model concept in strengthening staff team work. The approaches may be useful to other developers of team training programs. However, the methods used still needed to be refined. Additionally, there are many additional training ideas that could be implemented that would further enhance this training. Several ideas for enhancing mental models in teams are presented in Stout, Cannon-Bowers, and Salas (1996/1997) and Cannon-Bowers, Tannenbaum, Salas, and Volpe (1995).

The effectiveness of the shared mental model depends on the commander. The team observed two different types of commanders. One commander provided little feedback or direction to the staff, while the other commander was active and provided the staff specific feedback and direction on what he wanted. The difference in the learning environment created for the staff was apparent. The team learned that staff efficiency can only be optimized if the staff is

made aware of the commander's information requirements. Commanders must become involved if staffs are to maximize performance.

Development

Lessons learned regarding development are divided into three groups: exercise development, training system (software) development, and TSP development. There was an additional lesson learned that overlapped two of these groups--simultaneous exercise and software development. This lesson is discussed at the end of the development section.

Exercise Development

Message Traffic Development

Being totally computer driven, these TSPs provided an opportunity for the development team to structure exercises more tightly than any previous structured training program. The message traffic had to replicate all of the information coming into the staff yet not overwhelm the staff with messages. Developers learned that it is extremely time consuming to develop and thoroughly test the message database for structured computer-driven exercises.

Subject Matter Experts

During this project, the team discovered that there was a higher specificity of knowledge required than in previous projects. In earlier projects, the team was not required to develop the specific message traffic. These teams only had to develop the general flow of the battle. In the Staff Group Trainer exercises, the development team had to create highly detailed messages coming into the staff from every echelon and every supporting unit. To obtain this high level of detail, individuals involved in creating the messages had to be highly competent. As this type of structured staff training matures, the message traffic will need to be refined for the staff to receive correct, timely, detailed messages over the correct device. This type of detail can only be provided by individuals with current and specific knowledge of all aspects of the BOS. Future computer-driven exercises need to allocate ample funds to ensure that the technical subject matter expertise is made available.

Training System Development

All developers need a clear picture of the desired training environment. However, it is especially critical for software developers. If possible, they should also be provided information on potential expansions of the system. This information helps them design flexible, scaleable code which will make future development efforts less expensive. Given no direction, coders take low-risk coding approaches to ensure code meets delivery requirements. This code will have high reliability at an earlier development stage, but may lack the flexibility needed for expansion. To facilitate this, managers supervising this code development should be aware of potentials in the field (e.g., GUI features, such as "enable" and "disable" button selections; and options in system design, such as client server versus peer-to-peer design).

User-Friendly Interfaces

Although the system was drastically improved, it still needs an improved GUI to reach the ease of operation required for a fielded system. At the beginning of this project, the legacy system interfaces were difficult and time consuming for the developer team to use. The data input system developed in this project greatly simplified the developer input requirements. This was important because it allowed more exercise variations to be tested. The lesson learned is that developer tools must be considered in software development, not just software for end users.

Emulate Fielded Systems

The brigade commanders interviewed do not want valuable staff training time spent learning a computer system that only drives the exercise. They want staff members to practice on their own Army Tactical Command and Control System (ATCCS) systems; for example, the S3 section wanted to use their Maneuver Control System. To do this the ultimate training system could be embedded in the various ATCCS systems, emulate the user-interface characteristics of the actual tactical equipment, or be very easy to learn (less than one hour for proficiency).

If ATCCS equipment was emulated both operators and staff could be trained. The staff would focus on training the staff section in how best to use the system's capabilities.

Training Support Package Development

As discussed previously, the TSP includes both the paper-based instructions and more non-traditional items such as the system software, multimedia presentations (previews, and AARs), and the message database. The TSP also contains a "how to" conduct the training (train-the-trainer) program. The following sections discuss some of the lessons learned about both the paper-based portions and the non-traditional components.

Training Support Package Organization

During previous VTP structured training projects (SIMUTA, SIMUTA-B, and SIMBART), the development teams tried various ways to organize the paper-based TSPs to make them easier for a training team to use (R. G. Hoffman et al. 1995; Graves & Myers, 1997; Koger et al. 1996). In these projects, the training teams prepared execution preview materials, job aids, checklists, and starting and ending exercise materials. This project organized the paper-based TSPs into the five-volume sets described earlier. The O/C team felt this configuration was difficult to use. It required them to extract and copy TSP materials to make team member workbooks. Based on feedback from the O/Cs, the developers created workbooks that were approximately ten pages per exercise. These workbooks provided the O/Cs the material they needed and were evaluated as "user friendly."

The development team has learned that to be useful to the training team, the mandatory information--execution procedures and design philosophy--must be presented in a quickly digestible, user-friendly format. The paper-based TSP may not be the best means to provide materials. Potential ways to replace traditional paper may be formats such as videotape or computer-assisted instruction. Perhaps preview and AAR materials could be embedded on the

training system and some form of electronic clipboard or hand-held computer may offer relief from paper training packages for the training team. Various options need to be explored to provide job-aids and checklists to the training team. Future efforts should consider non-paper-based TSPs.

Structured Information Presentation

Structuring took place on several levels to include structured writing, message previews, and AARs. The following sections discuss the lessons learned in structuring at these levels.

Structured writing. Structured writing has been shown to be beneficial in previous VTP projects (Koger et al. 1996; Graves & Myers, 1997). In this project, the training team found that structured writing helped them understand the written material in the TSPs more quickly. In the prototype exercise reviews, the participants requested that even more use be made of some of the structured writing presentation techniques. Specifically, the participants wanted information in a short, to-the-point presentation. The short "bullets" rather than prose decreased the amount of time required to digest the materials. The team maximized structured writing principles (Horn, 1995) in the TSPs. In the future, paper-based TSPs should use structured writing.

Message formats. The original SIMUTA C/ST messages did not use standardized formats. The development team converted all messages to the formats in Field Manual 71-3 (Department of the Army, 1988a). The staff read messages in these formats and also used them to compose their own messages. Familiarity with the formats permitted participants to more rapidly parse information. Future projects should implement ATCCS formats where possible.

Previews. Multimedia previews were not part of the design. They were developed and implemented for some modules and exercises to examine their potential. The general situation multimedia previews were enthusiastically received by the staff and training team. Multimedia previews must continue to be developed if such training programs are to be exportable.

The development team discovered that high-quality previews are costly to develop. A dedicated, knowledgeable graphic artist with sophisticated software and hardware is necessary to keep costs at a reasonable level. While development team members became more proficient in scripting and composing the previews, thus decreasing the cost per preview, full implementation of dynamic/interactive links to training performance measures will increase costs.

Staff section-specific multimedia previews were not developed. Brown (1992) has suggested that while the staff section-specific previews are probably the most difficult to deliver, they offer the most training benefit. Part of this premise was qualitatively evaluated during this project. The development team provided detailed preview exercise materials to the training team for most of the exercises. When the material was used staff performance was positively impacted. Additional work is required to develop detailed material for each staff section for each exercise. After the material is developed and tested for effectiveness, resources should be devoted to prepare multimedia material for all staff sections. The development team has learned that maximum structuring of materials is necessary to ensure consistent, repeatable training.

After Action Reviews. The automated delivery of scripted message traffic in the Staff Group Trainer Project provided more structure to the training program than in previous programs. The impact of this structure was most evident in the AAR. The structured message traffic and events for an exercise provided the framework necessary to focus the AAR on specific training objectives that were cued by message traffic. The team designed a structured, multimedia AAR that kept the training team more closely aligned with the design and made AARs easier for the O/Cs to conduct. Since future computer-driven staff training programs need to be designed as exportable, easy-to-use packages, the structured, multimedia AAR will help a less experienced training team better achieve the training objectives. The computer-driven AAR also needs to be extended to the staff section level.

Observer Checklists. Observer materials must be explicit and not require extensive familiarity with the scenario. Instead of vague guidance, staff actions should specify behaviors for observers to look for.

Train-the-Trainer Requirements

The train-the-trainer program as designed required approximately three days. It was to be presented by an individual very knowledgeable of the program and its underlying concepts. After the brigade commander interviews, it became obvious that any exportable, useable train-the-trainer program must be significantly shorter and easier to implement in the field. The lesson learned is for the training developer to ensure that the train-the-trainer program is also designed and developed to meet the needs of the audience.

Simultaneous Exercise and Training System Development

Simultaneous training and software development led to scheduling difficulties. Software deliveries were not well aligned with the training development schedule. Training developers were not able to test the training exercises on the system until the pilots. If simultaneous training and software development is planned, schedules must be aligned to allow adequate internal testing prior to external testing. This may require more flexibility in test schedules or additional time allotted to compensate for unexpected problems.

The software lot development must be integrated in the program development of the non-computer components. This requires delivery of capabilities based on an analysis of how the code must be developed. For example, item 1 on the user's priority list might require that items 15 and 16 would need to be developed first. The coding requirements must be linked with the capabilities required to test the system during development.

Demonstrations

During the brigade pilot, there was a sensing that the training team had not been provided with a clear concept of the TSPs. At the start of the last day of the brigade pilot, the development team played the role of a brigade staff and executed one of the C^2 exercises. This demonstration allowed the training team to see how a staff was expected to execute the exercise on the training system. This demonstration appeared to clear up a number of questions the training team had

about how the training should be executed. Based on this response, the development team concluded that a demonstration would help both the training teams and the staffs understand how the training program was executed. The development team added a live demonstration to the start of the Train-the-Trainer Program and the staff orientation.

This demonstration was labor intensive. It required the training team to role-play as an entire staff. There are more efficient/effective ways to conduct this demonstration, e.g., videotape. A videotape could be used to highlight specifics of the training program. More work is required to develop the demonstration for this training program. When it is fully developed it should be placed on suitable media.

Implementation

There were two lessons learned in implementing this program, relating to the role and structure of the training team and the physical environment for the training.

Training Team

This project and previous VTP programs (R. G. Hoffman et al. 1995; Koger et al. 1996; Graves & Myers, 1997) have faced problems with acceptance of the training program design. This report discussed means of providing the training team with information and rationales for the training program using TSPs and the Train-the-Trainer Program. Cognizance of the design does not ensure acceptance. The training team must be convinced that the training program is effective given the time and fiscal restraints of tactical units. Achieving acceptance is difficult when the approaches are different than what they are convinced works.

Since this and the previous VTP programs were research projects, at least part of the explanation should include the fact that this is research and that the training design needs to be followed to determine its effectiveness. Only by being tested can the design be fully evaluated. The development team must take the time and effort to ensure:

- The training team leadership understands that this is a research project.
- In research projects some concepts are tested that do not work.
- In research projects the training team members must implement the training program's design to the best of their abilities so that the design can be evaluated.

The development team must involve the training team and participant staff leadership early in the program.

Physical Features

The participants commented that the staff sections should be laid out the same as in a CP. That means that the physical relationship between sections should be consistent with the actual unit operating environment. When it is not cost prohibitive, face validity should be implemented.

The participants also wanted the tasks performed similarly to the way they would be performed using their regular equipment. The most commonly made comment concerned posting the map. In the pilots and trials, there were no paper maps and associated overlays available to the staff. All of the work with maps was required to be done on the workstations. The participants wanted the ability to post maps in the same manner as in the field CP to allow transfer of training. In future training programs, the task of posting a map could be performed on either paper maps or on system maps, at the option of the participants (see equipment emulation discussed earlier). Paper maps, interestingly, were not of concern to the brigade commanders interviewed.

Evaluation

Several major lessons were learned in the evaluation phase. First, the formative evaluation model used in this program is a valid model. However, adjustments can be made in execution to improve results. Second, participants--as per the design plan--are key to a valid evaluation of a research training project.

Formative Evaluation Methods

During the project, the development team did not conduct the formative evaluation as they had planned. Certain portions were delayed or moved into later phases of development. As Tessmer (1993) pointed out, the resistance to revision increases as the project gets closer to completion. M. Hoffman (1986) indicated that every project has a pre-emption point. According to Hoffman, a pre-emption point is a point where changes can no longer occur because financial or emotional investment is too great to make the change. Since portions of the evaluation were moved closer to the project completion, the implementation of changes became increasing more difficult to make and still meet the contract delivery schedule. In effect, some of the evaluations were conducted either very near or beyond the pre-emption point.

The lesson learned is that each phase of a formative evaluation is important. Phases of evaluation should be conducted and revision recommendations provided early enough in the development cycle so that they can be used. Certain aspects of the formative evaluation, such as an expert review or one-to-one evaluation, should be done as early as possible in a project. Ample time needs to be scheduled into the development cycle to allow for revisions based on the formative evaluation. Without ample time for revisions, the evaluation's usefulness for that project may not be realized. Future projects, however, may be able to benefit from the evaluation.

Participants

Although many of the participants did an outstanding job of playing their roles, the staffs for the trials were not an actual battalion or brigade staff. These individuals assembled to form a surrogate staff only for the trial. They were usually the appropriate rank and branch or specialty. However, since this training program design was focused on training a staff to respond to the information needs of the commander, the ad hoc staff had serious short falls. These participants lacked the synergy and motivation of a regular staff working with their commander in a training

environment. The lesson learned in this project is that the target audience should be used in all trials.

CONCLUSIONS

Staff Group Trainer Project

The Staff Group Trainer Project developed TSPs bridging the gap between individual and integrated staff training. The training focused on preparing the staff to meet the commander's information needs. The progressive exercises trained the staff in their procedures and prepared them for their next level of training. The decision-making exercises led a staff through the complete staff support cycle.

Field commanders continue to express a need for battalion and brigade structured staff training. The Staff Group Trainer Project established a solid base for future design, refinement, and implementation. With downsizing, decreased opportunities for field training, and rapid staff turnover, the Staff Group Trainer technology provides a high-payoff training option.

The overhead for staff training cannot be labor intensive and should be largely invisible to the staff being trained. Today, staff personnel cannot afford to invest substantial time in learning how to use a training system. The support system must either emulate or run on actual equipment, or require a short training time. Further development of the Staff Group Trainer technology should explore these requirements.

A follow-on to the Staff Group Trainer Project to design and develop a program that can be implemented without a significant support staff should be considered. Commanders indicated that obtaining a large support staff or traveling to a training site for this type of training is not feasible. Any staff training program must be easy for the commander to use within his assets or with minimal augmentation and available at the commander's home station. Future developments of structured, computer-driven staff training systems must take into consideration field training needs and start with a front-end analysis. Program designs must then be generated in light of these needs.

Training Program Potential

The Army has a need for training tools to enable staff groups to become proficient at critical functions. Unit commanders want a program to train staff fundamentals prior to conducting more elaborate and costly training exercises. Such a program must:

- be turnkey,
- have low overhead requirements (training personnel),
- be easy to use, and involve short train-up requirements (administrators and trainees),
- consist of short, intense vignettes, and
- contain modules that take no more than half a day to complete.

A training team in which the commander is the senior trainer, even though team members may not be permanently assigned, remains a key component of a staff training program. The training program is his tool to train his staff. The training team must work for him and support his informational or situational requirements. To optimize training, the training team must have available a train-the-trainer program and TSPs which are concise, efficient, and easy to use.

Recommendations for Further Research

The following list is based on this project's lessons learned and summarizes areas for further research and development to meet unit commander's needs.

1. Further work is desirable to merge the BFs into new and existing structured training programs. Since the BF and the Staff Group Trainer Project were conducted concurrently many of the products developed in the BF project were not totally integrated into the training programs.
2. The training team availability for structured, computer-driven staff training programs will remain a problem within the Army. Further research should be conducted to determine minimum staffing requirements and trade-offs associated with various training team configurations.
3. Further work is needed to enhance the configuration and presentation of TSPs. Possibilities include:
   - Putting the TSP in an electronic medium.
   - Presenting some of the material in the TSP via multimedia techniques.
   - Using an electronic clipboard-type device for observer checklists.

4. Further improvements can be made to the train-the-trainer program. The program needs to be exportable, concise, and easy to use. Some form of multimedia or computer-assisted/managed training may be suitable. This program must be tied to the training team availability, number of trainers required, and the time constraints these individuals are under.

5. Further investigation into the utility and means of providing the staff pre-exercise materials is required. This project used multimedia for the general preview with very positive results. Effective means of presenting staff section-specific previews still need to be determined.

6. Investigation on whether the C^2 exercises are required to prepare a staff for Janus or BBS should be conducted.

The Staff Group Trainer Project advanced the development process of providing battalion and brigade staff training programs to the commander as a tool to train his staff. More work is required to refine these programs and the delivery system into a useable tool for the commander in the field. This project provided direction for future developments in this area.

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ACRONYMS and ABBREVIATIONS

AAR	After action review
AFRU	Armored Forces Research Unit
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
ATCCS	Army Tactical Command and Control System
BBS	Brigade/Battalion Battle Simulation
BC	Battle Captain
BF	Battlefield Function (formerly Critical Combat Function - CCF)
BOS	Battlefield Operating System
BSTS	Battle Staff Training System
C/ST	Commander/staff trainer (currently called Staff Group Trainer)
C^2	Command and Control
CATK	Counterattack
CCF	Critical Combat Function
COBRAS	Combined-arms Operations at Brigade Level, Realistically achieved through Simulation
COFT	Conduct-of-Fire Trainer
CP	Command post
CTCP	Combat trains command post
CVCC	Combat Vehicle Command and Control
DST	Decision Support Template
ENDEX	End of exercise
FC	Field Circular
FRAGO	Fragmentary order
FSB	Forward Support Battalion
FSO	Fire Support Officer
FXXITP	Force XXI Training Program
GUI	Graphic User Interface
ITTBBST	Innovative Tools and Techniques for Brigade and Below Staff Training
LAN	Local Area Net
NCO	Non-Commissioned Officer
O/C	Observer/controller
O/C/I	Observer/controller/interactor
OIC	Officer in Charge
OPORD	Operation Order
PSNCO	Personnel Staff Non-Commissioned Officer
R&D	Research and Development
RCVTP	Reserve Component Virtual Training Program
S1	Personnel Officer
S2	Intelligence Officer
S3	Operations Officer
S4	Logistics Officer
SGT	Staff Group Trainer

SIMBART	Simulation-based Mounted Brigade Training
SIMNET	Simulation Networking
SIMUTA	Simulation-based Multiechelon Training Program for Armor Units
SIMUTA-B	Simulation-based Multiechelon Training Program for Armor Units - Battalion Exercise Expansion
SOW	Statement of work
TAC CP	Tactical Command Post
THP	Take-home package
TOC	Tactical operations center
TRADOC	U.S. Army Training and Doctrine Command
TSOP	Tactical standing operating procedures
TSP	Training Support Packages
VTP	Virtual Training Program
XO	Executive Officer